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THE

CYCLOPÆDIA

OF

PRACTICAL MEDICINE.

VOL. I.

THE

CYCLOPÆDIA

OF

PRACTICAL MEDICINE:

COMPRISING

TREATISES ON THE NATURE AND TREATMENT OF DISEASES, MATERIA MEDICA
AND THERAPEUTICS, MEDICAL JURISPRUDENCE, ETC., ETC.

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"Hæc demum sunt quæ non subgessit phantasiæ imaginatricis temeritas sed phænomena practica
edocuere."—SYDENHAM.

IN FOUR VOLUMES.

VOL. I.

ABDOMEN—EMMENAGOGUES.

QUÆ PROSUNT OMNIBUS.

PHILADELPHIA:
LEA AND BLANCHARD.
1845.

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PREFACE FROM THE ENGLISH EDITION.

The Editors have at length the gratification of laying the Cyclopædia of Practical Medicine before the public in a completed state.

It is impossible for them to look at the list of the Contributors by whose assistance this work has been accomplished without a deep-felt satisfaction; distinguished as that list is by so many names of celebrity in modern medicine, and including so many of the professors and teachers in London, Edinburg, Dublin, and Glasgow, whose reputation conveys a high and just authority to their doctrines. To have directed some part of the scientific exertions of such writers to the pages of the Cyclopædia, and, also, to have elicited from not a few of the most accomplished among the provincial physicians of the empire, numerous and valuable contributions which but for the comprehensive plan of this work might never have been communicated to the profession, is a result to which the Editors must ever feel proud and gratified to have conduced.

With such efficient aid in all the parts of their undertaking, they have spared no personal pains, in the hope by uniformity of plan, simplicity of arrangement, and the harmony and consistency of its several portions, to make the Cyclopædia fully and fairly to represent the state of Practical Medicine at the time of its appearance. From innumerable foreign and domestic sources the scattered knowledge which has so fast accumulated since the commencement of the present century has thus been gathered together, and placed at the command of every reader of the English language. Those acquainted with the actual limitation of such knowledge before the appearance of this work, and who have opportunities of knowing how slowly even valuable novelties are diffused in a form giving any assurance of their worth, will best be able to appreciate the importance of the *extensive* means of reference which the Cyclopædia has at once introduced into the library of many English practitioners at home and abroad.

The ambition of the Editors was not limited to the formation of a mere manual, fitted for those who only demand the smallest supply of exact intelligence with which practice can be carried on, or professional station maintained without a palpable exposure of ignorance. Their object was no less than to prepare a compendium of the best parts of ancient and modern medicine, theoretical and practical; not passing over with disregard the vast literature of the ancient writers, but rather rescuing it from the voluminous oblivion in which much of it was lost; and also collecting with care the more accurate, condensed, and applicable knowledge of modern authors and of modern times into a liberal and consistent system, from works little known to the generality of English readers, and familiarly known to very few.

Thus, whilst the great claims of the older cultivators of medicine have never been forgotten, the labours of the moderns, and more particularly of the French, German, and Italian pathologists, by which, conjointly with those of British practitioners, the whole face of practical medicine may be said to have been changed, have attracted the most diligent and thoughtful attention. The learned reader does not require to be assured that the task of reference for specific information to many older works, once of high and deserved authority, and still esteemed, is often both tedious and little profitable, whilst their ample volumes yet contain much valuable matter, not unworthy of preservation, and which it is no fruitless employment to endeavour to place along with the better arranged facts of later writers, in one view, before the practitioner and the student. Throughout the prosecution of this large design, it has never been forgotten that the Cyclopædia would be referred to by various readers for various objects; by the young practitioner as the guide and counsellor of practice, especially when beset with practical difficulties; by the older practitioner for complete and concise information, and for medical learning not scanty and illiberal, but without scholastic pedantry; and by the student for applicable knowledge, suited to the actual time, collateral with and auxiliary to his prescribed studies, and satisfactorily directing the efforts of his inquiring mind.

At the commencement of such an undertaking, it was difficult not to call in question the probability of its meeting with adequate encouragement. No such work existed in this country; and although works on a plan somewhat similar had been very favourably accepted on the Continent, still it might have been urged that the English were eminently, almost exclusively, a practical people, — that their medicine, in the opinion of foreign critics, who appeared to be dispassionate and impartial, was essentially empirical,—and that until a very recent period undeniable prejudices existed in the minds of many English practitioners of known practical skill, against all attempts to append theory to the deductions of mere experience. Of the English works known to have been most profitable to their publishers, many were mere compilations, or of a description adapted to the contracted prejudices just alluded to; whilst works which have been thought deserving of translation into more than one foreign language, and had reflected honour on British pathology, had in our own country met with comparative neglect.

The progress of medicine during the last forty years had led to successive editions of the few systematic works already existing, to which the recent acquisitions of medical science were somewhat inconveniently, because incongruously, attached. The cultivation of general anatomy, the changes effected in physiology, and the immense advancement of the knowledge of morbid structure, required that the whole of Practical Medicine should be presented in that reconsidered and augmented state which had been the result of this progression. Several parts of medical study, bearing closely upon practice, had moreover undergone so much recent investigation as almost to constitute them new parts of medical science;— such as the effects of Climate on health and disease; the properties of Mineral Waters; the mode of action of Poisons, and indeed the whole subject of Medical Jurisprudence; as well as the new methods of exploring diseases of the chest and abdomen; the laws of epidemics, and the means of promoting disinfection; with many other questions of considerable interest. The greater intercourse which had taken place during a period of nearly twenty years of peace, between this country and the Continent, had opened vast stores of pathological facts in connection with almost every known disease, which yet remained imperfectly known to many to whom a general work would be accessible, and which no editor had yet sought to arrange and collate with the contemporaneous discoveries of our own authors, or to combine with the practical improvements acknowledged in our own country. Between respect for the old writers, and the continual contradictions of them occurring in those of later date; between the fame of the Continental authorities, and a lingering attachment to opinions of which all the foundations had been shaken; the student of medicine and the young practitioner found themselves embarrassed in the attempt to arrive at stable conclusions, or even to comprehend the actual state at which medicine had arrived, and which no general work at that time represented.

All these circumstances encouraged the presumption that if a work embodying all these improved parts of medical knowledge,—simply and conveniently arranged, and not unenriched by the treasures of an older period—full and accurate, but from which all the superfluous matter that had been admitted into some foreign works of a like form was carefully excluded,—were offered in the English language, its reception would be such as to satisfy all who were concerned in it, whilst its preparation would reflect no discredit on those who undertook it.

It was in no small degree gratifying to the Editors to find that the publication of the early numbers of the Cyclopædia was attended with circumstances which conveyed an assurance of the general correctness of these views. The circulation of the work soon extended to every portion of the British empire, to the Colonies, and to America; and the publishers have from time to time informed them that its sale was steadily proceeding. The Editors have undoubtedly received these intimations with pleasure; not only because they were connected with benefit derived by those who had adventured in a liberal undertaking, but because they thought they perceived in such circumstances a proof of an increasing zeal for exact and comprehensive knowledge on the part of British practitioners of every rank, in every part of the world.

However natural and proper it may be for the Editors to take a retrospective survey of the work when it is brought to a conclusion, and to examine with what fidelity they have fulfilled their engagements, and how far and how equally the various departments of practical medicine have in their turn occupied their attention, it is hardly possible to express the results of this retrospection in words which will not expose them to the charge of being disposed to look back upon their exertions with too much complacency. Yet they may perhaps be allowed to say, that if the reader will take the trouble to inspect the mere titles of the articles contained in these columns, comprehending nearly three hundred original essays of known and distinguished authors, and will bear in mind either the leading physiological divisions of diseases, or consider them with reference to the head, the chest, the abdomen, the surface, or the general condition of the body; as well as the subjects of obstetrical medicine, materia medica, or medical jurisprudence; he will sufficiently appreciate the care bestowed to make the Cyclopædia satisfactory to all who refer to its pages, and at the same time strictly a book of practical reference. No subject, it is believed, immediately practical in its nature or application, has been left out, although unnecessary disquisition has been as much as possible avoided.

It has consistently entered into their plan to admit of a far wider range of subjects than appears heretofore to have been considered necessary in works professedly written on the practice of medicine, but a range comprising many new subjects of extreme importance to those engaged in practice or preparing for it. Such are the subjects of Abstinence, Acupuncture, Age, Change of Air, Antiphlogistic Regimen, Asphyxia, Auscultation, Bathing, Bloodletting, Morbid States of the Blood, Climate, Cold, Contagion, Convalescence, Counter-irritation, Derivation, Congestion and Determination of Blood, Dietetics, Disinfection, Physical Education, Electricity, Endemic Diseases, Epidemics, Expectoration, Exploration of the Chest and Abdomen, Galvanism, Hereditary Transmission of Disease, Induration, Irritation, Infection, Latent Diseases, Malaria and Miasma, Perforation, Prognosis, Pseudo-morbid Appearances, Pulse, Softening, Medical Statistics, Stethoscope, Sudden Death, Symptomatology, Temperament, Toxicology, Transformations, Transfusion, Tubercle, Ventilation, Mineral Waters; and those of various general articles on the pathology of organs.

The several articles relating to Diseases of the Brain and Spinal Chord, and of their membranous coverings, including the important subject of the impairment of the mental manifestations, will probably be deemed by every candid reader to contain accurate views of morbid structure and faithful descriptions of the most important lesions of the nervous functions. How great the talent and how high the authorities on these subjects, will be at once seen by referring to the names of the authors of the articles Apoplexy, Inflammation of the Brain, Catalepsy, Chorea, Coma, Convulsions, Delirium, Epilepsy, Headach, Hydrocephalus, Hydrophobia, Hypochondriasis, Insanity, Latent Diseases, Paralysis, Plethora, Prognosis, Somnambulism, Diseases of the Spinal Marrow; Temperament, Tetanus, Wakefulness, &c. As regards the greater number of the authors of these articles, they are well known to have been previously in much esteem with the public for treatises more or less connected with the subjects on which they undertook to write for the present work.

The direction for many previous years of the attention of one of the Editors to Diseases of the Chest could not but make both him and his colleagues particularly desirous that on the subjects of the numerous and serious diseases of the lungs and of the heart, the Cyclopædia should contain the fullest and the most recent information; and that the novel and still too much neglected methods of physical investigation of Auenbrugger, Laennec, Andral, Piorry, and others, should be clearly and perfectly set forth. In the articles relating to these various maladies, contributed by Dr. Carswell, Dr. Cheyne, Sir James Clark, Dr. Darwall, Dr. Hope, Dr. Johnson, Dr. Law, Dr. Townsend, Dr. Williams, &c. it is hoped that no omissions will be found. These names are for the most part so familiar to the profession, in connection with the several subjects on which they have written in the Cyclopædia, that the titles of the different articles would alone have suggested them, in order to give the stamp of valuable authority to each.

As regards Diseases of the Abdomen, it may without any impropriety be mentioned that, in the articles Cholera, Colic, Diarrhœa, Dysentery, Enteritis, Epidemic Gastric Fever, Gastritis, Gastrodynia, Gastro-enteritis, Hæmatemesis, Hemorrhoids, Indigestion, Jaundice, Inflammation of the Liver, Peritonitis, Pyrosis, Tabes Mesenterica, Tympanites, Worms, Organic Diseases of the Stomach, Liver, Pancreas, Kidneys, &c. &c., is included a more elaborate and practical exposition of the pathology and symptomatology of the affections of the abdominal viscera generally, and of the gastro-intestinal mucous membrane in particular, than is contained in any single work previously published. The importance of correct views of this large class of common and much diversified disorders, as a basis of useful practice, is such as it would be quite needless to dilate upon. They involve consequences most seriously affecting the health of the body and the mind; and the mismanagement even of the lighter forms is largely productive of human discomfort and unhappiness. They are also, in some form or other, incidental to every constitution, and are literally of daily and hourly occurrence. From fever, the severest of the acute diseases from which medical care effects frequent recovery, to the habitual distresses produced by the imperfect digestion of food, they demand the continual attention of the practitioner. The relations of gastro-intestinal irritation with numerous disorders of the chest, head, skin, and extremities, and with fever, as causes or effects, are among the most interesting questions which have been agitated by the most eminent of modern physicians in this and in other countries, and the practical application of the researches of pathologists concerning the morbid states of the digestive mucous membrane remains an object anxiously sought by those acquainted with the exigences of various practice, and who are not content to practise without reflection.

So indiscriminate, also, generally speaking, is the treatment of the various modifications of indigestion,—the chronic irritations of the intestines are often so long overlooked,—so empirically are undefined disorders of the liver prescribed for,—and the conduct of the dietetical part of practice, even in fevers, and still more in chronic disorders, is so capricious,—that it may be permitted to the Editors to hope that some improvement may ensue from the circulation of the sounder and better founded notions of pathology and practice explained and advocated in the various essays on abdominal diseases which contribute to give value to these volumes.

The department of Cutaneous Diseases has, it will be seen, engaged the pens of Dr. Corrigan, Dr. Cumin, Dr. G. Gregory, Dr. Houghton, Dr. Joy, Dr. Kerr, Dr. A. T. Thomson, and Dr. T. J. Todd, by whom, as was to be expected, this important branch of study, which enjoys but a small share of popularity in this country, has received full pathological and practical illustration.

As regards some affections implicating the whole system, and particularly the fluids, it is but just to allude to the admirable treatises on Gout and Plethora, as being worthy of the high reputation before attained by the author of them as a philosophical physician and an experienced practitioner. Nor can the Editors pass silently over the elaborate article on Tubercular Phthisis, of which it is but one among many excellences that it invites the attention from that contemplation of local lesions which leads to practical results of little value, to a more enlarged consideration of the subject, pregnant with the most momentous practical consequences.

The names of Dr. Marshall Hall, Dr. Lee, Dr. Locock, and Dr. Montgomery, affixed to the several articles connected with the Diseases of Women and Children, will be a sufficient assurance to every reader that this responsible part of medicine has not been confided to inefficient hands. Nothing could be more compatible with the plan of the Cyclopædia than the brief, clear, and instructive essays furnished by these able and experienced practitioners.

In the interesting field of Medical Jurisprudence the work has been benefited by the original and masterly dissertations of Dr. Arrowsmith, Dr. Beatty, Dr. Christison, Dr. Montgomery, and Dr. Prichard.

The well-earned fame of Dr. A. T. Thomson gives to his numerous contributions on subjects comprehended in the department of the Materia Medica, an interest of which every student must be fully sensible; and it is but just to mention that for the limitation of these articles within narrower bounds than those which the author deemed essential to their full value, the Editors are solely accountable. With respect to the practical application of some other medical agents, as Galvanism and Electricity, the reader is enabled to avail himself of the valuable information communicated by Dr. Apjohn, and marked by his characteristic accuracy. To the same able writer the Editors have been indebted for the comprehensive treatise on Toxicology. In the parts of the work closely allied to chemical science, as in the articles Calculi and Mineral Waters, the Editors have been honoured by the contributions of Dr. Thomas Thomson, of Glasgow, who has been long known to the whole scientific world as one of the greatest authorities in modern chemistry.

The value of the aid afforded in the general articles relating to various parts of Morbid Anatomy, will be understood by all who know the great and deserved reputation of Dr. Carswell, both in England and on the Continent; a reputation which cannot but derive increase by his great work on that subject, and its incomparable pictorial illustrations, now in the course of publication.

Many able contributions, not specially alluded to in these observations, demand the general and warm acknowledgements of the Editors, as of a character not inferior to any which have been mentioned; and their especial obligations to Dr. Alison and Dr. Bostock will be evident to all who peruse with attention the Historical sketches prefixed to the practical portion of the Cyclopædia.

As tending in a considerable degree to place the contents of the work more completely before the reader for immediate consultation, and therefore important, although laying no claim to merit in itself, the Editors have added a very minute and extensive General Index.

Hoping to be excused for making these reflections on a work now laid before the profession in a finished state, the Editors will only add, that they have avoided multiplied and artificial divisions, and have aimed at that plainness of arrangement which most facilitates a ready and immediate reference. They have also shunned the fault of encumbering medical literature with new and uncouth terms, always preferring those in common use, and of which the signification was the least doubtful. It has been their constant desire to guard the most inexperienced reader from distraction in the pursuit of practical knowledge, and to assist the more advanced reader in the grouping and generalization of the ideas with which his personal experience may have imbued him.

One of the most delicate parts of the duty of the Editors in conducting these pages from their commencement to their termination, has been the occasional adaptation of the articles composing it to the character or to the proposed size of the whole work. Considerations which could not properly be put aside sometimes caused modifications to be absolutely necessary, in contributions which might have been published unchanged as separate essays. To say that this duty was in every case performed without difficulty, or with the entire and ready acquiescence of the writers, would be to assert what none who are versed in literary composition, or who know the natural feelings of authors, would give credit to. That it was always performed with a sincere regard to such feelings, and that no change of arrangement, and even no verbal alteration, was made without just deliberation, they may very truly affirm. They have the satisfaction of believing that such is the impression left on the minds of those contributors who have honoured them with their assistance. With many, before unknown to them, except by reputation, the Editors have the happiness to feel assured that permanent freindship has arisen out of what was at first but casual co-operation.

In conclusion, the Editors entertain a hope that they have prepared a work required by the present wants of medical readers, acceptable to the profession in general, and so capable by its arrangements of admitting the progressive improvements of time, as long to continue what the general testimony of their medical brethren, as far as it has hitherto been expressed, has already pronounced it to be, a standard British work on the Practice of Medicine.

If such should prove to be the event, they will feel themselves abundantly repaid for the labours which it has imposed upon them.

PREFACE OF THE AMERICAN EDITOR.

It is now upwards of twenty years since the undersigned agreed to engage with Dr. Copland and the late Dr. Gordon Smith, in the preparation of an Encyclopædiac Dictionary of Practical Medicine, which should hold the same relation to the department of Medicine, that Mr. S. Cooper's Surgical Dictionary does to that of Surgery. The project was conceived and advertised in the year 1824, in the "London Medical Repository," of which Dr. Copland and the undersigned were editors. A prospectus of the undertaking was drawn up, and arrangements were made for its publication with the Messrs. Underwood, of London. Towards the latter end of that year, the undersigned left England for the University of Virginia; and the panic, which prevailed in 1825 in the commercial world, according to Mr. Pettigrew, (Medical Portrait Gallery, Art. Dr. Copland,) caused the publishers to relinquish the undertaking. It probably, however, gave the impulse to the appearance of the "Cyclopædia of Practical Medicine," of Drs. Forbes, Tweedie, and Conolly. Of the signal value of this great work, there is but one sentiment. The general voice of the profession everywhere has, indeed, sufficiently shown, that the hope expressed by the British editors, in their Preface, has been amply realized. It is admitted, that they have prepared a work required by the present wants of medical readers, acceptable to the profession in general, and in all respects "a standard work on the Practice of Medicine." It was for this reason, and owing to the high opinion expressed of its merits by those on this side of the Atlantic, who had the good fortune to consult its pages, and to the anxiety of the best informed that it should be rendered more available to the profession in this country, that the publishers determined, at a great outlay of money and of labour, to reprint it.

At their request, the undersigned consented to superintend the republication, to revise the various articles, and to make such additions and modifications as he might deem desirable. To this determination he was impelled, in part, by his knowledge of the accomplished editors, and his consequent anxiety, that the different articles should be preserved, as far as practicable, in their pristine integrity. Generally speaking, they were so full and comprehensive, that but little modification seemed to be necessary. In all cases, however, the undersigned has endeavoured to add the facts and opinions, which form part of the medicine of the day, and to omit nothing calculated, in his view, to throw additional light on the subjects canvassed. These additions he has striven to make in such a manner as not to interfere with the general tenor of the articles; and to cause them to read as if they had proceeded from the pen of the original writers. The interstitial additions are enclosed in brackets [ ]. Besides these, he has inserted different topics, which had been wholly omitted in the English edition, some of which are essentially American in their character. To these additions his signature is appended. For one article, on the History of American Medicine before the Revolution, he is indebted to Dr. J. B. Beck, of New York.

In making these additions, the undersigned has endeavoured to be as brief as perspicuity would permit; and, where his opinions have been fully expressed elsewhere,—to avoid repetition, he has referred to them for further details. On every occasion he has been anxious to cite the views and observations of cotemporary, and particularly of American, writers, where such views and observations appeared to him to merit especial notice.

Appearing, as the work originally did, in parts, articles were necessarily omitted in their proper places, and many were thrown into a supplement. This defective arrangement has been rectified as far as was practicable, so that the American edition will, in this respect, be found to possess advantages, as a book of reference, over its English prototype.

The History of Medicine, which, in the English edition, was prefixed to the alphabetic portion, takes its proper place in the third volume of the American edition.

One subject only has been omitted—Medical Bibliography—which formed an appendix to the last volume of the English edition, and was subsequently published in a distinct form. This the publishers determined to discard, in consequence of the additional cost to the purchaser, which its insertion would occasion; and of their conviction, that notwithstanding its intrinsic value to a few, and the high character of its author—Dr. Forbes—it would be considered wanting in interest and importance to the many on this side of the Atlantic, who will seek the work as a guide to Practical Medicine.

ROBLEY DUNGLISON.

LIST

OF THE

CONTRIBUTORS

TO THE

CYCLOPÆDIA OF PRACTICAL MEDICINE,

AND OF

THE ARTICLES WRITTEN BY EACH AUTHOR.

Alison, W. P., M.D. F.R.S.E. Professor of Medicine in the University of Edinburgh, &c.

- Medicine, history of, in the present century.

Apjohn, James, M. D. M.R.I.A. Professor of Chemistry to the Royal College of Surgeons in Ireland.

- Combustion, spontaneous human.
- Electricity.
- Galvanism.
- Toxicology.

Arrowsmith, R., M.D. Physician to the Coventry Dispensary.

- Infanticide.

Ash, Edward, M.D. Physician to the Norwich Dispensary.

- Hiccup.
- Prognosis.
- Syncope.

Bardsley, James L., M. D. Physician to the Manchester Royal Infirmary, Dispensary, &c.

- Diabetes.
- Hydrophobia.

Barlow, Edward, M.D. Physician to the Bath United Hospital and Infirmary.

- Antiphlogistic regimen.
- Congestion of blood.
- Determination of blood.
- Education, physical.
- Gastrodynia.
- Gout.
- Plethora.
- Rheumatism.

Beatty, Thomas Edward, M.D. Professor of Medical Jurisprudence to the Royal College of Surgeons in Ireland, and Consulting Accoucheur to the Baggot-Street Hospital, Dublin.

- Impotence.
- Dead, persons found.
- Rape.
- Sex, doubtful.
- Survivorship.
- Wounds, death from.

Beck, J. B., M.D. Professor of Materia Medica, in the College of Physicians and Surgeons, New York.

- Medicine, American, before the Revolution, History of.

Bigsby, John J., M.D. F.L.S. Senior Physician to the Newark Dispensary.

- Spleen, diseases of.

Bostock, J., M.D. V.P.R.S. F.L.S. F.G.S. &c. &c.

- Medicine, history of.
- Pulse.
- Urine, morbid states of the.

Brown, Joseph, M.D. Physician to the Sunderland and Bishopwearmouth Infirmary.

- Cholera.
- Contagion.
- Disinfection.
- Dysentery.
- Fever, intermittent.
  - remittent.
  - hectic.
- Hereditary transmission of disease.
- Infection.
- Malaria and miasma.
- Plague.
- Ventilation.

Burder, Thomas H., M.D. Member of the Royal College of Physicians, London.

- Erethismus mercurialis.
- Headach.
- Jaundice.

Burne, John, M.D. Physician to the Carey-Street Dispensary.

- Otalgia and Otitis.
- Hemorrhoids.

Carswell, Robert, M.D. Late Professor of Morbid Anatomy in the University of London.

- Induration.
- Melanosis.
- Mortification.
- Perforation of the hollow viscera.
- Scirrhus.
- Softening of organs.
- Tubercle.

Carter, H. W., M.D. F.R.S.E. Physician to the Kent and Canterbury Hospital.

- Delirium tremens.
- Ischuria renalis.
- Kidneys, diseases of.
- Nephralgia and Nephritis.
- Pancreas, diseases of the.

Cheyne, John, M.D. F.R.S.E. M.R.I.A. Physician-General to the Forces in Ireland, &c.

- Croup.
- Epilepsy.
- Fever, epidemic gastric.
- Laryngitis.
- Wakefulness.

Christison, Robert, M.D. Sec. R.S.E. Professor of Materia Medica and Therapeutics in the University of Edinburgh, &c.

- Latent diseases.

Clark, Sir James, M.D. F.R.S. Physician to the Queen and Prince Albert, &c.

- Air, change of.
- Climate.
- Tubercular phthisis.

Clutterbuck, Henry, M.D. Physician to the General Dispensary.

- Apoplexy, cerebral.

Conolly, John, M.D. late Professor of Medicine in the London University, and Physician to the Hanwell Lunatic Asylum.

- Alteratives.
- Disease.
- Hysteria.
- Medicine, practical, principles of.

Corrigan, Dominick J., M.D. Physician to Jervis-Street Hospital, Dublin.

- Pemphigus.
- Plica Polonica.
- Rupia.

Crampton, John, M.D. M.R.I.A. King's Professor of Materia Medica, Physician to Steeven's Hospital, &c. Dublin.

- Cyanosis.
- Diarrhœa, (with *Dr. Forbes.*)

Crawford, Adair, M.D. Assistant Physician to the London Fever Hospital.

- Brain, inflammation of the substance of (Cerebritis).
- Coma.
- Convulsions.
- Inflammation, (with *Dr. Tweedie.*)

Crawford, Andrew, M.D. Physician to the Hampshire County Hospital, Winchester.

- Bronchocele.
- Chorea.

Cumin, William, M.D. Member of the Faculty of Physicians, Glasgow.

- Calculus, pathology and treatment.
- Cystitis.
- Dysuria.
- Incontinence of urine.
- Pityriasis.
- Psoriasis.
- Rickets.
- Scrofula.
- Sycosis.

Darwall, John, M.D. Physician to the Birmingham General Hospital.

- Anasarca.
- Artisans, diseases of.
- Ascites.
- Dropsy.
- Hydropericardium.
- Hydrothorax.
- Œdema.

Duesbury, Frederick, M.D. Physician to the Dispensary, and to the Invalid Asylum, Stoke Newington.

- Transformations.

Dunglison, Robley, Professor of the Institutes of Medicine in Jefferson Medical College, Philadelphia, and attending Physician to the Philadelphia Hospital.

Besides the interstitial additions, the following distinct articles:

- Acrodynia.
- Anæmia, (with *Dr. Marshall Hall.*)
- Anthracion.
- Aphthæ, (with *Dr. A. Robertson.*)
- Asphyxia of the newborn.
- Blood, morbid states of, (with *Dr. M. Hall.*)
- Bronchial Glands, diseases of the.
- Bronchitis, summer.
- Cachexia.
- Cholera infantum.
- Cirrhosis of the lung.
- Colon, torpor of the.
- Croup of the adult.
- Delirium tremens.
- Dengue.
- Diarrhœa, adipous.
- Disinfectant.
- Enteritis, (with *Dr. Stokes.*)
- Eutrophic.
- Fever, malignant remittent.
- Galvanism, (with *Dr. Apjohn.*)
- Glanders.
- Heart, polypus of the.
- Intussusception.
- Jaundice of the infant.
- Laryngitis, chronic.
- Milk-sickness.
- Mind, soundness and unsoundness of, (with *Dr. Prichard.*)
- Molluscum.
- Nauseants.
- Ophthalmia, (with *Dr. Jacob.*)
- Palpitation, (with *Dr. Hope.*)
- Parturients.
- Ptyalism.
- Rheumatism, (with *Dr. Barlow.*)
- Sedatives, (with *Dr. A. T. Thomson.*)
- Spermatorrhœa.
- Spleen, diseases of the, (with *Dr. Bigsby.*)
- Statistics, medical, (with *Dr. Bisset Hawkins.*)
- Stomatitis.
- Strophulus.
- Throat, diseases of the, (with *Dr. Tweedie.*)
- Toothach.
- Toxicology, (with *Dr. Apjohn.*)

Elliotson, John, M. D. F.R.S. Physician to St. Thomas's Hospital, and late Professor of Medicine in the London University.

- Acupuncture.
- Neuralgia.

Forbes, John, M.D. F.R.S. Physician in ordinary to her Majesty's Household, &c.

- Abdomen.
- Angina pectoris.
- Asthma.
- Auscultation.
- Bathing.
- Chest, exploration of.
- Diarrhœa (with *Dr. Crampton.*)
- Feigned diseases, (with *Drs. Scott* and *Marshall.*)

Gillkrest, J., M.D. Deputy Inspector-General of Hospitals, London.

- Fever, yellow.

Goldie, George, M.D. Shrewsbury, late Physician to the York County Hospital.

- Hæmatemesis.
- Melæna.
- Purpura.
- Urine, bloody. (Hæmaturia.)

Grant, James, M.D. Jedburgh.

- Nyctalopia.

Gregory, George, M.D. Physician to the Small-pox Hospital.

Chicken-pox.
Small-pox.
Vaccination.
Varicella.

Hall, Marshall, M.D. F.R.S. L. & E. &c.

Abstinence.
Anæmia.
Blood, morbid states of.
Bloodletting.
Chlorosis.
Diagnosis.
Puerperal diseases.
Symptomatology.

Hancock, Thomas, M.D. Liverpool.

Endemic diseases.
Epidemics.
Influenza.

Hastings, Charles, M.D. Physician to the Worcester Infirmary, &c.

Constipation, (*with Dr. Streeten.*)

Hawkins, Bisset, M.D. F.R.S. Professor of Materia Medica and Therapeutics in King's College, London.

Statistics, medical.

Hope, J., M.D. F.R.S. Assistant Physician to St. George's Hospital, London.

Aorta, aneurism of.
Arteritis.
Dilatation of the heart.
Heart, diseases of the.
Heart, fatty and greasy degenerations of.
Heart, diseases of the valves of the.
Heart, hypertrophy of the.
Palpitation.
Pericarditis and carditis.

Houghton, James, M.D. Physician to the South-Eastern Dispensary, Dublin.

Lepra.
Lichen.
Noli me tangere, or Lupus.
Pneumothorax.
Scabies.
Urticaria.
Stomach, organic diseases of.

Jacob, Arthur, M.D. M.R.I.A. Professor of Anatomy to the Royal College of Surgeons in Ireland.

Amaurosis.
Ophthalmia.

Johnson, Charles, M.D. Professor of Midwifery to the Royal College of Surgeons in Ireland.

Hooping-cough.

Joy, William Bruce, M.D. Fellow of the King and Queen's College of Physicians in Ireland, and Physician to the Dublin General Dispensary.

Catalepsy.
Dentition, disorders of.
Eczema.
Elephantiasis Græcorum.
Erythema.
Fever, infantile remittent.
Glottis, spasm of the.
Hydrocephalus.
Tabes mesenterica.
Worms.

Kay, J. P., M.D. Physician to the Ardwick and Ancoats Dispensary, Manchester.

Transfusion.

Kerr, William, M.D. Physician to the Northampton General Infirmary.

Epistaxis.
Fungus hæmatodes.
Glossitis.
Hydatids.
Parotitis.
Pellagra.
Pyrosis.
Scorbutus.
Tympanites.
Yaws.

Law, Robert, M.D. Fellow of the King and Queen's College in Ireland, Physician Extraordinary to Sir Patrick Dun's Hospital.

Hæmoptysis.
Pleurisy, pleuritis.

Lee, Robert, M.D. F.R.S. Physician to the British Lying-in Hospital, London.

Abortion.
Fever, puerperal.
Ovaria, diseases of the.
Phlegmasia dolens.
Uterus and its appendages, pathology of the.
Veins, diseases of the.

Locock, Charles, M.D. Physician-accoucheur to the Queen, Physician to the Westminster General Lying-in Hospital, &c.

Amenorrhœa.
Convulsions, infantile.
Convulsions, puerperal.
Dysmenorrhœa.
Lactation.
Leucorrhœa.
Menorrhagia.
Menstruation, pathology of.

MacAdam, David H., M.D. Physician to the South-Eastern General Dispensary, Dublin.

Peritonitis, (with *Dr. Stokes.*)

Montgomery, William F., M.D. Fellow and Professor of Midwifery, to the King and Queen's College of Physicians in Ireland.

Identity, personal.
Pregnancy and delivery, signs of.
Rubeola.
Succession of inheritance.—Legitimacy.

Paris, J. A., M.D. F.R.S. President of the Royal College of Physicians, London.

Dietetics.

Prichard, J. C., M.D. F.R.S. Physician to the Infirmary and to St. Peter's Hospital, Bristol.

Delirium.
Hypochondriasis.
Insanity.
Somnambulism and animal magnetism.
Mind, soundness and unsoundness of.
Temperament.

Quain, Jones, M.D. Professor of Anatomy and Physiology in the London University.

Brain, inflammation of the membranes of, (Meningitis.)

Robertson, Archibald, M.D. Physician to the Northampton General Infirmary.

Aphonia.
Aphthæ.

Roget, P. M., M.D. Sec. R.S. Consulting Physician to the Queen Charlotte's Lying-in Hospital, and to the Northern Dispensary, &c.

Age.
Asphyxia.

Scott, John, M.D. Edinburgh.

Barbiers.
Beriberi.
Elephantiasis Arabum.
Feigned diseases, (with *Drs. Forbes* and *Marshall.*)

Stokes, William, M.D. Physician to the Meath Hospital, Dublin.

Derivation.
Dysphagia.
Enteritis.
Gastritis.
Gastro-enteritis.
Liver, inflammation of.
Peritonitis, (with *Dr. MacAdam.*)

Streeten, Robert J. N., M.D. Physician to the Worcester Dispensary.

Constipation, (with *Dr. Hastings.*)

Symonds, J. A., M.D. Physician to the General Hospital, Bristol.

Tetanus.

Thomson, A. T., M.D. F.L.S. Professor of Materia Medica and Therapeutics in the London University.

Anthelmintics.
Antispasmodics.
Astringents.
Cathartics.
Diaphoretics.
Diuretics.
Emetics.
Emmenagogues.
Expectorants.
Favus.
Herpes.
Ichthyosis.
Impetigo.
Narcotics.
Refrigerants.
Sedatives.
Stimulants.
Porrigo.
Prurigo.
Tonics.

Thomson, Thomas, M.D. F.R.S. L. & E. Regius Professor of Chemistry in the University of Glasgow, &c.

Calculus, (chemical composition.)
Waters, mineral.

Todd, T. J., M.D. Physician to the Dispensary, Brighton.

Achor.
Acne.
Alopecia.
Bullæ.
Ecthyma.
Ephelis.
Indigestion.

Todd, Robert B., M.D. F.R.S. Professor of Physiology and General Anatomy, King's College, London.

Paralysis.
Pseudo-morbid appearances.
Suppuration.
Spinal marrow, diseases of.

Townsend, Richard, M.D. M.R.I.A. Fellow of the King and Queen's College of Physicians, Dublin.

Apoplexy, pulmonary.
Atrophy.
Emphysema.
Emphysema of the lungs.
Empyema.
Heart, displacement of.
Hypertrophy.
Rupture of the heart.

Tweedie, Alexander, M.D. F.R.S. Physician to the London Fever Hospital, and to the Foundling Hospital.

Abscess.
Colic (with *Dr. Whiting.*)
Convalescence.
Erysipelas.
Exanthemata.
Fever, continued.
Inflammation, (with *Dr. Adair Crawford.*)
Miliaria.
Roseola.
Scarlatina.
Throat, diseases of the.

Venables, R., M.D. London.

Liver, diseases of.

Watson, Thomas, M.D. Physician to the Middlesex Hospital, &c.

Hemorrhage.

Whiting, John, M.D. Physician to the Surrey Dispensary, &c.

Anodynes.
Cold.
Colic, (with *Dr. Tweedie.*)
Colica Pictonum.

Williams, Charles J. B., M.D. F.R.S. Professor of Medicine in University College, London.

Bronchitis.
Catarrh.
Coryza.
Counter-irritation.
Dyspnœa.
Expectoration.
Incubus.
Irritation.
Malformations of the heart.
Obesity.
Pneumonia.
Stethoscope.

THE
CYCLOPÆDIA
OF
PRACTICAL MEDICINE.

ABDOMEN (Exploration of the).—It is intended, in the present article, to give a brief account of the different methods employed by physicians for *exploring*, or physically examining, the external parts of the abdomen, with the view of discovering or discriminating the diseases of the viscera contained in this cavity. The term here adopted to designate the application of these methods (from the verb *exploro*, to examine), although long received into our language, has been only very recently used in medicine in its present sense: it has been borrowed from the pathological writings of the French. In many parts of the present work occasion will be found of pointing out the paramount importance to the practitioner of a minute and accurate diagnosis of diseases, and of stating, in detail, the various methods in use for acquiring this knowledge. Of these methods none are so certain in their results, and, consequently, so satisfactory to the mind, as those which are based on what are termed *physical signs of disease*, in contradistinction to the more common class of rational or sympathetic signs which are derived from the more variable phenomena of disease termed *symptoms*. It is with the physical signs of diseases that exploration, in the sense in which we shall employ it, has to do; and in the present article it is intended to restrict its use to a part only of the physical signs by which abdominal diseases are distinguished.

Physicians are often much too negligent in examining the external parts of the body in internal diseases. From inadvertence, carelessness, or mistaken delicacy, they thus deprive themselves of the simplest, readiest, and surest means of recognising many important affections. This remark applies chiefly to the diseases of the abdomen and chest, some of which are strikingly expressed, if we may so speak, on the surface—either in a permanent change of configuration, or in a temporary alteration of the natural movements, or both. Such important physiognomical diagnostics can only be obtained (except in rare cases) by uncovering the body; and they can, in general, be immediately obtained by doing so. It happens constantly to those who are accustomed to examine the surface of the body in internal affections, to meet with examples of important diseases being mistaken or overlooked, merely because this simple proceeding had been neglected by the practitioner. One of the most common cases of this kind is chronic pleurisy, the presence of which is often detected by a single glance at the naked chest; one side being found to be immovable, and either contracted or enlarged beyond the limits of the healthy state. Superficial inflammations of the parietes of the chest and abdomen have been treated as phlegmasiæ of the viscera in persons who had no desire to conceal their complaints; while others, from unwillingness to admit the existence of local eruptions on the skin, have equally deceived their medical attendants. It is obvious that such mistakes could not happen to those who are accustomed to examine the exterior parts of the body; and it will not be denied that, whenever they do happen, they must tend to lower the character of the practitioner in the eyes of his patient. Such mistakes are much more liable to be made respecting females than males, partly on account of the greater delicacy respecting examination entertained by the physician in the case of the former, and partly owing to the greater obstacles to examination from the peculiar nature of their dress.

It will not, we trust, be imagined, from the above remarks, that the writer wishes to recommend the examination of the naked chest or abdomen in every case of alleged disease in these cavities. In most instances, even when a minute investigation is required, it is unnecessary to remove the under garment; and in the case of females this is never to be done if it can be avoided. In some cases, no doubt, it may be expedient to apply the hand to the skin, and even to inspect it freed from all covering; but in the case of females more particularly, neither should be had recourse to, unless an accurate diagnosis cannot be otherwise obtained.

If physical examination is of such general importance as a means of diagnosis, it is especially so in the diseases of the abdominal cavity. The great number and importance of the organs contained in it, render its diseases proportionally numerous and important; while the proximity and intermixture of some of the organs, and the variable site of others, render their symptoms complex and multifarious, and their diagnosis consequently difficult. On the other hand, the abdomen, from its anatomical structure, seems at first sight to promise much greater facilities for the employment of physical diagnosis than either of the two other great cavities of the body. Its soft and yielding walls at once invite and admit of such examinations of the parts within as appear to be altogether forbidden by the inflexible bony defences of the others. It will, however, be seen hereafter, that, in regard to the chest, this superiority of the abdomen is only apparent in as far as relates to the certainty of the results; although it is undoubtedly real in respect of the directness and obviousness of the methods of exploration which are applicable to it.

Previously to describing these methods, it is necessary to notice the topographical relations of the exterior surface of the abdomen to the parts within. This kind of knowledge is of the greatest importance to the practical physician in regard to many parts of the body, but more particularly the chest and abdomen. Without it he will constantly be left in doubt respecting the parts affected with disease, and will frequently be led into the error of attributing the symptoms of one suffering organ to another. With the view of facilitating the acquisition of knowledge of so much value, and of enabling the practitioner accurately to record his own observations, and to communicate to others precise information respecting the seat and signs of internal diseases, it has been customary to map out the exterior surface of the chest and abdomen into different compartments, termed *regions*, by means of imaginary lines described upon it, corresponding with imaginary planes passing to the centre of the body. These lines have not always been drawn in the same manner: on the contrary, there has ever existed great discrepancy among the writers and teachers of this and other countries respecting the number, the extent, and the names of the regions. This is a circumstance greatly to be regretted; and it is much to be desired that some arrangement could be proposed which might attain general assent from teachers and practical writers. It is probable that no plan can be proposed that is without even obvious defects; but it would be greatly for the benefit of the student and the practitioner if there were a fixed plan of any kind, *one* plan universally adopted, even if defective in some of its parts. At present hardly any two teachers or writers adhere to the same division or nomenclature.

In the annexed regional plans of the trunk of the body, (designed and executed by Mr. Paxton, of Oxford,) the nomenclature and divisions most generally adopted have been as much as possible adhered to; but it was occasionally found necessary to differ in both these points, in order to attain what appeared to be objects of practical importance. We have gone upon the fundamental principle of defining every region accurately, in every individual case, by drawing all the lines perfectly straight, and between points that are at once fixed in their nature and obvious to the senses. By these means there can never be any doubt as to the intended place or extent of particular regions, whatever objections may be raised against the propriety of the divisions. As it was found advisable to extend the same vertical lines over the two great cavities of the trunk, we are under the necessity of introducing the diagrams of the chest in conjunction with those of the abdomen, in order to point out the fixed points from which the lines are drawn. We shall only, however, in this place, take notice of the abdominal regions, which, it will be seen, are quite distinct from those of the chest.

The various regions are, as we have said, bounded by straight lines, or rather by direct lines drawn between fixed points, on a rounded or uneven surface. The vertical lines which have reference to the abdomen are five in number, and run as follows: 1. from the external tubercle of the pubes (or insertion of Poupart's ligament) to the acromial extremity of the clavicle (right and left side); 2. from the posterior boundary of the axilla (or inferior edge of the latissimus dorsi) to that point of the crest of the ilium, on which it falls vertically (right and left side); 3. along the spinous processes of the vertebræ from the sacrum to the nape of the neck. The transverse lines are four in number, and are drawn exactly in horizontal planes, as follows: — 1. on the point of the xiphoid cartilage; 2. on the last short rib; 3. on the anterior and superior spinous process of the ilium on each side; 4. on the upper margin of the os pubis. We have thus three horizontal and five vertical bands, and thirteen regions in all; of which five may be termed anterior, four lateral (two on each side), and four posterior. Their names are as follows: — *anterior regions*, epigastric, umbilical, hypogastric, inguinal (right and left); *lateral regions*, hypochondriac (right and left), iliac (right and left); *posterior regions*, inferior dorsal (right and left), lumbar (right and left). We have not carried the subdivision of the inferior zone to the posterior and lateral parts of the trunk; because the parietes there are of such a nature as to prevent us from deriving any aid in the investigation of the subjacent parts from exploration.

There are few more useful exercises for the anatomical student than endeavouring to imprint on his mind some plan of this kind, and to teach himself by observation, and by multiplied experiment on the dead subject, the precise relations of the regions to the viscera that lie beneath them. He ought always to consider his knowledge as

Fig. 1.

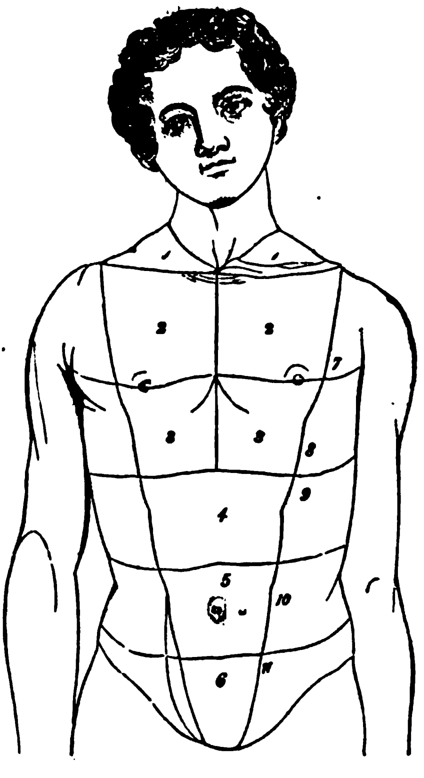


Fig. 2.

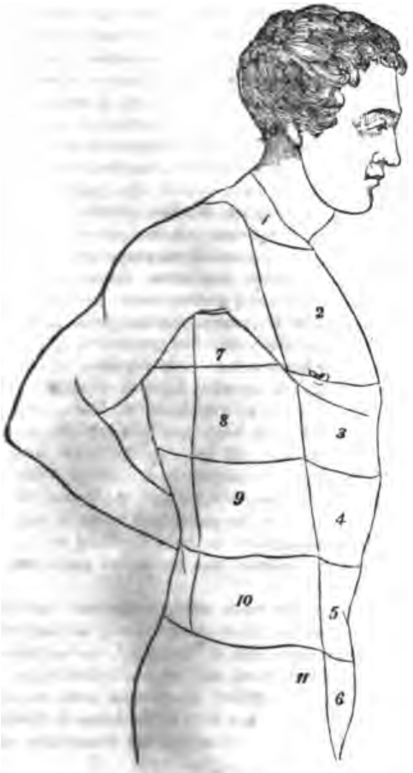
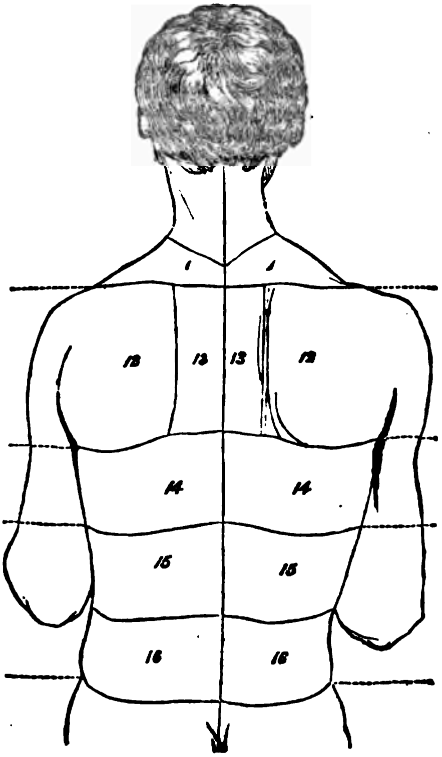


Fig. 3.



EXPLANATION OF THE FIGURES.

Abdominal Regions.

4. Epigastric.
5. Umbilical.
6. Hypogastric.
9. Hypochondriac.
10. Iliac.
11. Inguinal.
15. Inferior Dorsal.
16. Lumbar.

Thoracic Regions.

1. Humeral.
2. Subclavian.
3. Mammary.
7. Axillary.
8. Subaxillary or Lateral.
12 Scapular.
13. Interscapular.
14. Superior Dorsal or Subscapular.

imperfect, until he is able to state, with considerable accuracy, the organs, or parts of organs, that will be wounded by a stiletto thrust in at any point. It is only after possessing such a degree of knowledge, that he can enter, with full advantage, upon the study of the various methods of *exploration* which we are now about to detail, or that he can expect to derive from them the great practical benefits which they are calculated to supply.

The methods of exploring the abdomen may be reduced to three — *inspection, manual examination* (or *palpation*), and *percussion.* We shall notice them in order.

I. Inspection. This term is here used in its simplest sense, as restricted to the operations of sight only.

By inspection we judge of the size, form, and movements of the abdomen. The two last-named conditions are, perhaps, better ascertained by this than by any of the other forms of exploration. It is needless to point out in how many instances our judgments respecting the nature of diseases, as derived from other signs, are modified by the size of the abdomen. This is an important diagnostic sign in many diseases, both acute and chronic, more particularly perhaps in the diseases of infants; and it is often equally valuable as aiding prognosis, especially in fevers and other acute diseases.

The mere form of the abdomen, independently of its size, is no less valuable as a sign, in many cases. By this alone we are sometimes enabled to form a probable conjecture, if not to decide at once, respecting the seat and nature of a disease; although a practitioner could not be justified in acting upon such knowledge without having recourse to other signs and other modes of exploration. In pregnancy, in ovarian dropsy, in ascites, tympanites, and enlargements of the liver, the form of the abdomen is different. In certain cases, the direction of the inferior border of the ribs assists us in determining whether enlargements of the epigastric and hypochondriac regions originate in the abdomen or within the chest. In the former case, we may expect the border of the ribs to be turned outwards; in the latter, inwards, with, probably, a bulging out of the ribs above this point. In some examples of enteritis and colica pictonum, the nature of the pain is very similar; but the form and size of the abdomen are often very different, and sufficient to discriminate the two diseases. In the one the abdomen is distended, in the other contracted. In some of the severer febrile affections of children, the form and size of the abdomen afford valuable signs to assist us in determining a question frequently of great difficulty, viz. whether the principal seat of the disease is in the internal mucous membrane or in the brain.

The movements of the abdominal parietes are equally worthy the practitioner's attention. In many cases, these movements are characteristic of particular morbid states, and very considerably assist diagnosis, more especially when viewed together with the motions of the thorax. In peritonitis, enteritis, and other inflammatory diseases of the abdomen, likewise in great distension of the cavity from dropsy, pregancy, tumours, &c. &c. the parietes frequently remain motionless during respiration, while the movements of the chest are proportionally increased. The reverse obtains in analogous affections of the thoracic viscera. In cases in which both sides of the chest are rendered immovable by pain or physical incapacity, the abdominal movements are often increased to a remarkable extent. This is particularly observed in the case of double pleurisy, and also in asthma. In the paroxysms of this last affection, however, the form and movements of the abdomen are very different from those observed in the former. In asthma, the walls of the chest and the diaphragm are forcibly retracted, and cling to the imperfectly expanded lungs; the abdominal muscles are also drawn in towards the diaphragm, but are at the same time forced into violent yet very limited action.

II. Manual examination, or palpation.* By the simple touch, or application of the hand without pressure, we judge of the size, form, degree of sensibility, and temperature, of the external walls of the abdomen; and by touch, combined with pressure, (palpation,) we attempt to ascertain yet more accurately the condition of the internal organs. For the performance of the former part of the process, no other position of the patient is requisite but that which permits the free access of the hand to the surface of the abdomen; but for the successful exploration of the internal parts, it becomes necessary that the patient should assume that posture which is most favourable for the relaxation of the abdominal muscles. This result is best obtained when the patient is laid on the back, with the head moderately raised and bent forwards on the breast, the arms extended by the sides, the thighs bent nearly at right angles on the trunk, the knees apart and turned outwards, and the feet resting on the bed in contact with each other. When so placed, the patient should be made to understand that he is to exert as little muscular effort as possible in retaining his position; and we are to take care that such exertion is not forced upon him by any proceeding of ours which can be avoided. Sometimes the mere coldness of the hand, or even the simple touch, has the effect of throwing the abdominal muscles into action. Apprehension of pain from pressure has the same effect; and, likewise, misapprehension of our wishes respecting the condition of the abdominal parietes. In such cases we shall generally find, after a short time, that the muscles relax gradually of their own accord, particularly if the patient's attention is diverted from our proceedings; or we succeed in our object by causing the individual to take a deep inspiration, to cough, or speak; by which means the state of tonic tension of the muscles is destroyed. Sometimes, however, we find it impossible to obtain a complete relaxation; and this circumstance is of itself an important sign, and taken in conjunction with others is well deserving the attention of the practitioner. The patient, in these cases, seems instinctively to keep the muscles in a state of tension, in order to ward off the pressure from the parts beneath, some of which are inflamed, and therefore morbidly sensible. This state of the muscles is often found in inflammation of the intestinal mucous membrane.

It is of the more consequence to ensure the complete relaxation of the muscles, because their tension not merely prevents the accurate examination of the parts beneath, but even occasions the muscles themselves to be mistaken for enlargement or induration of the viscera. This remark applies more particularly to the recti muscles, the prominent bellies of which sometimes simulate pretty accurately the inferior border of an enlarged liver. We have often seen this mistake committed at the first moment of exploration; and, although generally, it has not always been corrected by further examination.

The chief objects we have in view, in exploring the abdomen, are the following: — To ascertain, 1, its form and size; 2, its degree of tension or solidity; 3, its temperature; 4, its sensibility; 5, the presence or absence of tumours of the viscera, or new growths within the cavity; 6, the presence of fluids in the peritoneal sac; 7, the nature and extent of the intestinal contents, &c. Some of these require much more attention than others. We shall only notice, with any degree of minuteness, such of them as are of most importance.

The form, size, degree of temperature, tension and superficial sensibility of the abdomen, are ascertained by the simple application of the hand to the different parts of it in succession, or, at most, by the gentlest pressure. Some precautions, however, and some further attention, are requisite, in order to enable us to ascertain the true degree of temperature and sensibility of the parts.

Owing to the singular infidelity of our sensations as a measure of temperature, the greatest care is necessary to prevent our being misled in judging of the degree of heat from the testimony of our hands alone. Every body knows that our perceptions of warmth have relation as much to the preceding as to the actual sensation. We are apt to consider a body as warm, solely because it is of superior temperature to one previously touched; and we may almost immediately be induced to reckon the very same substance cold, after touching one that is of a temperature greatly higher. The temperature of the hand itself is also to be taken into account, and not merely its actual temperature, but its habitual temperature. Some persons have hands habitually cold, and others habitually warm; and it is not likely that such persons will judge similarly of temperature, even when their hands chance to be equally warm at the period of experiment. It is still less likely that they will agree if their hands are of different temperature. In examining the temperature of the abdomen, or of any other part of the body, it will be most safe to judge rather of the relative than of the absolute degree of heat; and this will be best done by examining alternately other parts of the body presumed to be in a state of health.*

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* "Palpation, the act of feeling."—Johnson. From *palpo*, or *palper—palpatio*.

The temperature of the abdominal surface is frequently an important sign of disease. If very elevated, it indicates inflammation of the subjacent parts, or, at least, that increased afflux of blood, which cannot be practically discriminated from the early stage of inflammation. If that singular, and, we believe, still unexplained pungency, which attends certain febrile and inflammatory affections, is present, the complication renders the sign still more significant of severe disease.

In exploring the degree of sensibility, the pressure should, of course, in the first place, be made in the gentlest manner, and with the open hand. If the surface is impatient of the slightest touch, we may be assured that the cause of the tenderness is in the parietes. If no superficial tenderness exists, we proceed to examine the parts more freely by compressing the parietes more or less forcibly, and in different directions. Sometimes we find that a change in the direction of the pressure produces very different results in the same part. In peritonitis, for instance, direct downward pressure towards the spine is sometimes borne tolerably well, when pressure in a lateral direction, particularly such as forces the abdominal peritoneum to slide over the intestines, occasions extreme pain. In chronic diseases, much greater freedom may generally be used in our explorations; and when considerable doubt exists respecting the nature of a disease, we should endeavour to bring every organ of the abdominal cavity within the sphere of our explorations.

Some physicians, in exploring the abdomen, seem to consider it sufficient merely to pass the hand across it once or twice, using a very gentle pressure in the suspected places. Such a method is often more calculated to mislead than to instruct. It may, indeed, satisfy the patient that his case has met with due attention, while he has, at the same time, been treated with gentleness and delicacy; but it cannot be satisfactory to the practitioner who knows the value of this mode of investigating disease. But while we recommend the propriety of a free exploration, it is necessary to caution the young practitioner against adopting one of unnecessary violence. Some physicians make use of so much pressure, or rather they apply it in so injudicious a manner, that they hardly ever fail to elicit from the patient the expression of pain in the suspected region. This is particularly the case when the pressure is made, with the very points, or still more with the *nails* of the fingers; or when the soft parts are compressed against such as are solid. No very general rules can be laid down in such cases. Experience of the natural sensibility of the parts to pressure, in health and disease, can alone give the true practical tact; but even experience, we find, may here, as in other circumstances, be over-mastered by the influence of theory and prejudice acting on a weak judgment or a warm imagination. In every case, while exploring the sensibility of the abdomen, it is important to watch the expression of the patient's countenance; as this is often found to be a truer index of his sensations than his words are.

If, in the course of our exploration, we discover any unusual swelling or indurated part, we must endeavour to ascertain its nature and various relations,—its exact site, size, form, consistence, connexions, and degree of sensibility; whether it contains a fluid or not, whether it is pulsatile or not, and whether it is fixed or movable. All these circumstances are of consequence. The situation, size, and form of the swelling will enable us to judge respecting the organ or part affected; its consistence, degree of sensibility, &c. will help us to the knowledge of the nature of the tumour itself. In persons that are of a spare habit, and in whom the abdominal parietes are relaxed, and more particularly in women and children, whose muscles are naturally small and feeble, we are able to ascertain the condition of almost all the parts contained in the abdomen with considerable minuteness, and to an extent beyond what is commonly believed by practitioners. In many cases, for instance, it is easy to feel the mesenteric glands when enlarged, and even the kidneys. We must, however, be careful, in making these free examinations, not to mistake natural conditions of the parts for morbid deviations. Masses of indurated fæces in the colon, and even the spinal column, have been mistaken for morbid growths. (*Bianchi*, Hist. Hepat. 325. *Double*, Semeiol. t. i. 383.) Errors of this kind may, in general, be avoided. The movableness of the fæcal masses ought to point out their nature; and the extreme fixedness of the spine, as well as its form and direction, will hardly permit such a mistake to be committed by any one possessed of a common degree of anatomical knowledge.

In examining the abdomen with the view of detecting fluids accumulated in its cavity, we, in some respect, reverse the preparatory steps recommended in searching for more solid matters. In exploring for fluids, we wish the abdominal parietes to be in a state of tension rather than relaxation: and, with a view to obtain this result, if the patient is in bed, and cannot conveniently get up, we make him lie quite flat, with the head low and the legs extended; or we even increase the abdominal tension still further by placing a pillow under the loins. It is, however, still better if the patient can be placed in the erect position; as the abdominal walls are thereby rendered naturally tense, and the fluids are accumulated at the inferior and anterior parts of the cavity, in place of being intermixed with, and in some degree hidden by, the intestines, as is partly the case when the patient is in the horizontal position. The little manœuvre for ascertaining the fluctuation of the fluid is universally known. It consists, simply, in placing the palm of one hand against one side of the abdomen, with a firm but gentle pressure, and tapping smartly with the other hand directly opposite to it on the other side. If fluid is present, the impulse will be transmitted through it to the other hand, producing a peculiar vibratory shock which cannot be mistaken, after having been experienced a certain number of times. The import of this fluctuation as a sign of disease is well known: it is almost pathognomonic of ascites, or dropsy of the peritoneum. It is, however, also found in other diseases of the abdomen; and is generally acknowledged to be of importance, both positively and negatively, in aiding their diagnosis. For the various diseases in which it is employed as a sign, we refer to the different articles of this work, in which these diseases are treated. And we would here observe once for all, that in drawing up the present paper we have always had in view the ampler diagnosis which will be found under the head of individual diseases; our object not being to establish the diagnosis of particular diseases, but to give the practitioner a general outline of the methods of exploration which are more or less applicable to all the diseases of the abdomen.

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* Nothing can show the imperfection of mere sensation as a test of temperature, more strongly than the fact constantly observed, of patients and their attendants reporting particular parts as preternaturally hot—"burning hot,"—which are found, on trial, to be of the natural degree of warmth.

If this were the place for such disquisitions, it were easy to show, from the authority of the best practical authors of all ages, how very important a place in the diagnosis of diseases has been always assigned to the physical exploration of the abdomen. In the early ages of physic, this practice was, from various circumstances, much more in use than afterwards. Subsequently to the discovery of the circulation of the blood, when so much reliance was placed on the indications of the pulse, and when men's minds were so much occupied by theoretical and metaphysical distinctions, the physical investigation of diseases generally, and of those of the abdomen among the rest, fell into neglect. It has, however, during the last fifty years, and more especially during the present century, more than regained its pristine estimation with all well-informed physicians, and is at length secured from all future decadence on the immovable basis of organic pathology. With good reason, therefore, we may conclude this imperfect exposition of the method of palpation, as applied to diseases of the abdomen, in the words of Hippocrates and Baglivi. "Certain it is that he who examines the abdomen, as well as the pulse, is much less likely to be deceived than he who does not."* "If physicians were always to examine the abdomen, upon first visiting the patient, more particularly in acute diseases, they would assuredly commit much fewer mistakes than they do at present, neglecting this method of exploration. The knowledge of the condition of the upper parts of the abdomen improves vastly both our treatment and our prognosis."†

III. Percussion. (From percussio—percutio—per and quatio.) This form of abdominal exploration had been used as an occasional aid to diagnosis from very early times. The manœuvre for detecting the fluctuation of liquids, mentioned under the last head, is a mode of percussion; and the very name so long borne by one morbid condition of this cavity (*tympanites*, from τυμπανον, *a drum*) is at once sufficient evidence of the practice, and of its antiquity. It is only, however, of very recent date that any attempt has been made to establish a formal and elaborate system of diagnosis, applicable to diseases of the abdomen, by means of percussion. M. Piorry, a young Parisian physician, has the honour of having, if not invented, at least brought into a formal and matured shape, this new application of the discovery of Auenbrugger, and with practical results of greater precision and importance than could have been anticipated.‡

In the article Auscultation a full account will be given of the principles upon which percussion, as a general means of diagnosis, is founded. At present, nothing more will be attempted than a mere practical exposition of the method as applied to the discrimination of abdominal diseases. We shall only so far anticipate the details of the article referred to as to state that there are two methods of eliciting sounds from the surface of the body by percussion, with the view of judging of the physical condition of the parts beneath, — the one termed *direct percussion*, or, simply, *percussion*; the other *mediate percussion*. The former is the proceeding proposed by the great discoverer of the method, Auenbrugger, and consists in simply striking the part in a particular manner, with the points of two or more fingers united; the latter differs very little either in principle or practice, except that a thin plate of solid and elastic matter, as of wood or ivory, is interposed between the fingers and the surface of the body. In exploring the chest by means of percussion, the comparative solidity and elasticity of its walls, as well as the nature of its contents, render the interposition of a sonorous body between the fingers and its surface less necessary, although it will be seen that this is useful even there; but in the case of the abdomen such assistance is absolutely necessary to the production of sufficient sound to enable us to judge of the condition of the viscera within. In the following observations it will, therefore, be understood that *mediate percussion* is the method always spoken of. The small ivory plate on which the percussion is made has been termed, by its inventor M. Piorry, *the pleximeter*, or measurer of percussion. In exploring the abdomen by this method, we make use of various degrees of force in applying the plate to the surface, so as to depress this more or less, according to the objects we have in view. In many cases percussion on the plate pressed slightly on the surface, yields a very different sound from that elicited from it in the very same spot, when it is pressed deeply into the cavity of the abdomen. In the former case, the sound may be perfectly tympanitic, owing to the proximity to the surface of the intestines containing air; while in the latter it is often dull or dead, from the circumstance of the plate having been depressed below the level of the floating intestines into mediate contact with some solid or fluid body incapable of yielding similar sounds.

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* Deinde qui manibus contrectavit ventrem [ac venas], minus falli potest, quam qui non contrectavit. *Hippoc. Prædict.*, lib ii., § v.

† Si medici nostri temporis omnium ægrotorum hypochondria statim tractarent, in morbis potissimùm acutis, pauciores certè committerent errores quàm faciunt spretâ hypochondriorum observatione. Qui bene noverit hypochondriorum statum in morbis, quàm bene curare noverit, quam bene præsagire! *Baglivi de Prax. Med.*, lib. ii., cap. 9. Op. p. 30.

‡ The two following works, by M. Piorry, are well worthy the reader's attention:—

1. De la Percussion Médiate. Paris, 1828.
2. Du Procédé Opératoire à suivre dans l'Exploration des Organes par la Percussion Médiate. Paris, 1830.

In the following brief sketch of the results of abdominal percussion, we shall, in a great measure, follow M. Piorry, referring the reader to his elaborate work for further information. It will scarcely be credited, by those who have never practised, nor seen practised, this method, to what a singular degree of minuteness of diagnosis M. Piorry has carried it. Such persons may probably be disposed to consider many of his statements as founded in delusion, if not in fiction. But it may be well for them to recollect that the discoveries of Laennec were so designated by many on their first promulgation; while, at present, within the short period of a dozen years, only an insignificant minority call in question the truth of even the most remarkable of them. We do not pretend to have verified all the statements made by M. Piorry; and, indeed, nothing short of the indomitable zeal of a young Parisian pathologist of the present day could enable any one to do so within a moderate space of time; but from our knowledge of the results that are obtained from percussion as applied to the chest, and from numerous trials of it in abdominal affections, since the publication of M. Piorry's first work, we entertain no doubt of the general accuracy of his conclusions. At the same time we must admit, that to reach such a nicety of acoustic tact as is implied in several of the results recorded by him, will require more leisure and continued application than most men engaged in practice can afford to give. But such a practical acquaintance with the method as will be found highly useful, may soon be acquired by any one; and we consider it the duty of every practitioner to endeavour to acquire thus much at least.

The position of the stomach relatively with the surface is well known. In general, it occupies the epigastric and left hypochondriac regions, its greater extremity occupying the latter, and its smaller extremity extending to the right side of the epigastric region, or even into the superior part of the right iliac. But its position varies extremely, according to its degree of fulness, and the condition of the neighbouring viscera. It varies also greatly in respect of its proximity to the abdominal parietes. In the great majority of cases, some part of its surface lies in immediate contact with the abdominal parietes, more especially when it contains a considerable quantity of ingesta. When empty, or nearly empty, it sometimes is retracted towards the spine, while the colon or ilium lies in the front of it. As the stomach very generally contains a considerable portion of air, percussion over its usual site commonly yields a very clear sound. The clearness of this sound is found to be gradually diminished as food or drink is taken. When the stomach is filled to repletion, it yields nearly as dull a sound as the solid viscera. When it contains, at the same time, a considerable quantity both of air and liquid, percussion produces a peculiar sound, termed *humoric* by M. Piorry, and which has a sort of silvery, vibratory clearness, somewhat resembling the *metallic tinkling* of Laennec. This sound is observed in other parts of the abdomen, where there is an accumulation of air and liquid either in actual contact or in contiguous cavities. It is not, however, peculiar to this condition of parts, being also found wherever the air is forced out of a large cavity through a small opening. The knowledge of the condition of the stomach, as to emptiness or repletion, and likewise as to the general quality of its contents when full, may be very useful in many cases, both in practical medicine and in medical jurisprudence. When we know, from the history of the case, that the viscus is empty, or, at least, that it does not contain any food, a completely dull sound elicited from its usual site will indicate that some considerable morbid change has taken place either in it or the neighbouring parts. Its habitual tympany will be manifested by signs of an opposite kind.

In the state of health, the large intestines almost always contain a very considerable quantity of air; the small intestines generally contain some also. In consequence of this circumstance, percussion over their respective sites yields the tympanitic sound in a greater or less degree, in proportion to their proximity to the surface, the size of the intestine, and quantity of air contained in it. The cœcum being one of the most fixed parts of the intestinal canal, and generally containing a considerable quantity of gas, renders the right iliac region usually sonorous in the state of health. From this point we can also, in general, trace the transverse arch of the colon, by means of a tract of clearer sound across the upper part of the umbilical region to the left iliac region. It is well known how constantly this intestine contains a large quantity of air. The left iliac region generally yields a duller sound than the right, but not always; the result being dependent on the particular portion of intestine lodged there, and the state of its contents. The sigmoid flexure, which most commonly occupies this region, contains, in general, more fæcal matter than the cœcum or the transverse arch of the colon, and therefore yields a duller sound.

The small intestines usually occupy the greater part of the centre of the abdomen, filling the umbilical region, and encroaching, more or less, upon all the adjacent regions. They may be said to be, in a considerable degree, surrounded by the colon. They generally contain some air in the state of health; but a great deal less in proportion to their size and other fæcal contents, than the large intestines: they, therefore, yield much less sound on percussion. When they contain very little air and much chymous fluid, they hardly give any of the tympanitic resonance. This natural dulness is sometimes increased by disease within the bowel, but it is, we believe, much more frequently diminished. The increased dulness in the regions occupied by the sonorous portions of the intestines is most commonly occasioned by disease external to their canal. In affections of the mucous membrane, a morbid augmentation of the quantity of gas usually contained in the bowels is much more common than a diminution of it. In many cases, the intestines are extremely distended with gas throughout the greater part of their whole course; and when this distension is of some continuance, it has been frequently described as a distinct disease, under the name of *tympanites* or *tympany*, from the drum-like tension of the abdomen produced by it, and the loud sound elicited on percussion.

It is obvious that a practitioner, well acquainted with the various kinds and degrees of sound usually elicited in health from the regions chiefly occupied by the hollow viscera, may derive much important information calculated to aid his diagnosis and prognosis, and to regulate his practice, by attending to the modification of those sounds produced by disease. In relation to this point, it suffices to notice the different judgment that will be formed in two cases having the same degree of swelling, but with the sound quite dull in the one, and tympanitic in the other.

When the bladder of urine is at all distended by its natural contents, so as to project beyond the edge of the pubes, its presence may always be easily ascertained by percussion. It yields a dull sound, like that of ascites, which contrasts well with the clear intestinal sound on all sides of it, but is yet of a different character from that yielded by a solid tumour. M. Piorry assures us that it is even possible to ascertain the presence and dimensions of the *gall-bladder* by the same means. We have never attempted to verify this statement.

The presence of the solid viscera and of solid growths of a morbid kind is ascertained chiefly by the contrast of their dull sound with the resonance of the intestines around. It is, therefore, important to be well acquainted with the natural seat and limits of these viscera in the state of health.

In judging of morbid states of the liver, sufficient allowance is not always made for varieties that occur in its position, independently of any disease in the organ itself. Disease of the right cavity of the chest will occasion retraction or depression of the liver, according as it is of a kind to elevate or depress the diaphragm. Diseases of the abdomen will have the same effect by a reverse operation. Alteration of the shape of the lower part of the chest from the effects of stays, sometimes occasions a remarkable change in the relative position of the liver as well as of the stomach. From this cause the liver is sometimes completely hidden beneath the compressed border of the thorax; at other times its left lobe is thrust before the stomach into the left hypochondriac region, or depressed into the umbilical. Besides, the size of the liver varies considerably in different persons, and in the different periods of life. In the majority of healthy and well formed persons, its lower border scarcely descends below the margin of the ribs, or encroaches upon the scrobiculus cordis. The situation and size of the liver, both in health and disease, are well ascertained by percussion. It is bounded by the stomach on the left side, and the colon below, both generally containing air; and it is accurately bounded above by the lungs, always, in health, full of air: it lies, therefore, yielding its dull sound, in the midst of a sonorous region. If the practitioner is well acquainted with the ordinary size of the healthy organ, and takes into account all the circumstances that can influence its position in the individual case before him, he will not often be mistaken respecting the actual size of the liver, nor have much difficulty in determining whether this size is to be considered morbid. Manual examination will here be of great value, as far as respects the inferior or abdominal border of the liver; but percussion and auscultation can alone point out the upper limits of the viscus.*

The situation of the spleen being a good deal dependent on that of the stomach, is less fixed than that of the liver; still, generally speaking, it may be said to be placed in the left superior dorsal region immediately below the diaphragm, and a little to the left of the spinal column. It is entirely covered by the ribs. Being surrounded on all sides, like the liver, by hollow viscera containing air, (except when it adjoins the kidney,) it would be very easily distinguishable by percussion, if it were placed as close to the exterior of the body as the liver is. But this is not the case; and we cannot, therefore, expect either the same distinctness in our signs, or accuracy in our diagnostics, here, as in percussion of the hepatic region. Still, there can be no doubt that when the spleen is enlarged so as to displace the floating viscera, and approach the side, its presence may be readily recognised. M. Piorry, indeed, says that its exact site may be ascertained, in most cases, even in health.

The kidneys are usually seated about the middle of the inferior dorsal region, on a level with the last dorsal and two upper lumbar vertebræ. Being separated from the surface by the thick mass of the lumbar muscles, it is hardly to be expected that their place should be indicated by percussion; and we confess that we never made the experiment. If this accuracy of diagnosis were attainable, we are somewhat doubtful if it would be of any use. Still M. Piorry assures us that, both in health and disease, percussion is capable of making known the position of the kidneys, when exercised with certain necessary precautions detailed by him.

In no morbid condition of the abdominal cavity are the results of percussion more satisfactory than in the case of liquid effusions into the peritoneum. In most cases, either inflammatory or simply dropsical, the effused fluids seek the lowest level, according to the position of the patient, leaving the hollow viscera, containing air, to float partially above them. Over the space occupied by the latter, percussion will, of course, elicit the tympanitic resonance; while over that occupied by the denser liquid, the sound will be comparatively dull or dead. In general, the demarcation of the sonorous and dull regions is very abrupt and distinct; and is proved, by experiment, to be always that of the temporary level of the fluid. Change of position immediately alters the relative positions of the dull and tympanitic regions. For example: in the case of a moderate accumulation of fluid, when the patient is in the erect position, the whole of the lower parts of the abdomen, viz.: the hypogastric, inguinal, and part, at least, of the epigastric, iliac, and inferior dorsal regions, will yield the dull sound; but if the patient assumes the horizontal posture, all the anterior regions will resume the tympanitic resonance, while the dulness will be transferred to the whole of the lateral and dorsal regions. The degree of dulness of sound is found to be increased in proportion as the percussion is made low down in the regions containing the fluid. It was formerly stated that, if in cases of moderate effusion we press the plate forcibly upon the abdomen, we frequently reach a point where percussion elicits a dull sound, although it had elicited a clear sound from the same spot when the plate was only pressed gently upon the surface. The fact is explained by the pleximeter having in the former case reached the level of the fluid in the abdominal cavity, after displacing or compressing the hollow bowels which had been floating above it. These various results indicative of the presence of fluid are frequently obtained when the quantity is so small as to be undiscoverable by fluctuation. As they are equally observed whether the effusion is the consequence of inflammation or simple dropsy, they will be found in most cases of peritonitis; and, therefore, percussion will prove, not merely a diagnostic of this disease, but a valuable aid in discriminating it from enteritis, properly so called. In inflammatory affections of the abdomen, it is necessary to be very gentle in our operations on account of the painful state of the parts; and, in such cases, it may be further requisite to employ a broader plate, with the view of diffusing the pressure more equably over the tender parts.[*]

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* It is impossible to notice every peculiarity of disease that may interfere with the manifestation of the usual sounds of health; or to lay down rules of diagnosis applicable to every such peculiarity. While engaged in writing the preceding remarks, we met with an instance of this sort, in the case of a man affected with ascites and anasarca. In this case, the liver was evidently very small, at least in its inferior portion, because percussion elicited the clear tympanitic sound over all the border of the ribs and for a couple of inches above this. It was also evident that there was no accumulation of water in the chest, at least to any extent; and there existed no sign of pulmonary disease. On the lower part of the right side of the chest, above the usual site of the liver, there was, however, a space of three inches broad, including the nipple, and stretching laterally to a considerable extent, which yielded a perfectly dull sound. Was this the liver stretching so high into the thorax? or was it a tumour attached to the diaphragm? Dissection explained the difficulty at once. It appeared that this man on some former occasion had had inflammation of the peritoneal coat of the upper face of the liver, which had terminated in *partially* attaching the viscus to the diaphragm in such a way as to form, by the adhesion, a shut but empty sac between the peritoneal coats of the liver and diaphragm. On the supervention of the dropsical disposition, this portion of the serous membrane threw out its serum like the rest; but having no outlet, it accumulated; and finding the diaphragm more yielding than the liver, it thrust the former upwards into the chest in the form of a tumour. The sac contained nearly a pint of serum.

In the encysted dropsy of the abdomen, the results of percussion are, in several respects, different; and the differences supply means for enabling us to distinguish the two affections. In the encysted dropsy the sound is much duller; the fluid not being able to change its place, the sphere of dull sound is almost fixed; or if the whole cyst changes its place, which it sometimes does in different postures of the patient, the hydrostatic line of level is never formed as in the case of the loose effusion. In these cases, also, we frequently find the tympanitic resonance *beneath* the cyst, which could not be the case in simple ascites; and the line of demarcation between the dull and sonorous regions is seldom quite *straight*, as in the last-named disease. It is hardly necessary to caution the reader that, in all these cases, no one should be so imprudent as to trust to percussion alone in forming a diagnosis. In all kinds of cysts, as well as in other tumours, developed among the floating viscera, palpation will be, at least, of equal value with percussion. There are, indeed, few cases, if any, in which the one should be employed exclusively of the other, in the investigation of abdominal diseases. In the case of solid tumours, as of cysts, when they approach the surface, and thereby displace the floating viscera, they yield the dull sound on percussion. When seated more profoundly, the dull sound is only obtained by depressing the abdominal parietes to the level of the solid mass.

Percussion is sometimes productive of the best results in cases of indurations and tumours of the abdominal parietes, such as chronic abscess in the interstices of the muscles. In such cases it is sometimes difficult to decide, especially in fat persons, whether the tumour has its seat within the cavity; and here we have found percussion afford great aid in removing the difficulty. When the tumour is seated in the parietes, percussion, when applied with sufficient force, will elicit the clear sound, however solid the tumour may be, if it is not of much greater size than is usually the case in such instances. In a solid tumour, springing from within the abdomen itself, and pressing against the parietes, the sound will be perfectly dead.

JOHN FORBES.

ABORTION, (*abortus*,) signifies the expulsion of the fœtus from the uterus before its different organs have been sufficiently developed to enable it to support an independent life. When the product of conception is expelled between this period and the full term of utero-gestation, the process is usually termed *premature labour*.

Abortion is a frequent occurrence in the early months of pregnancy, particularly among women of the lower classes of society, who are exposed to much bodily fatigue and mental anxiety. [Dr. Collins, of Dublin, met with 293 premature cases in 16,414; and Dr. Beatty, with 21 premature cases in 1200. Dr. Churchill records 65 cases of abortion in 1705 deliveries; Madame Lachapelle, 116 cases in 21,960; and M. Deubel, 35 in 420; making, in all, 530 premature cases in 41,699 deliveries, or 1 in 78½. It has been suggested by Dr. Guy as probable, that the small proportion observed by Madame Lachapelle is owing to the fact, that the females, who came under her observation at La Maternité, were in the latter months of pregnancy, when abortions are comparatively rare; and the same explanation may apply to other cases.] It is most liable to occur in plethoric, irritable, and nervous subjects; in women who are affected with constitutional diseases, more especially syphilis; in those who have deformity of the bones of the pelvis, or some organic disease in the uterine organs. All the chronic diseases, therefore, to which the uterus and its appendages are liable, may be considered causes of abortion. The production of polypi in the cavity of the uterus, or of fibro-cartilaginous tumours in its walls, and morbid adhesions of the uterus to the surrounding viscera, may all, by impeding the regular enlargement of the gravid uterus, give rise to premature expulsion of its contents.

Other predisposing causes of abortion, though less evident than those now enumerated, are also usually admitted by authors: for example, leucorrhœa, irritability or too great contractility and rigidity of the uterine fibres and blood-vessels. Those who have insisted on rigidity of the uterine fibres as a cause of abortion have been led into error, by supposing that the uterus enlarges during pregnancy by the mere force of the mechanical distension of the ovum, and not by the gradual developement of all the textures of the organ, in exact correspondence with the growth of the organs of the fœtus.

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[*] M. Tarral has recently described a new mode of detecting abdominal effusions, which he terms *superficial fluctuation*, (*fluctuation périphérique*). His description of it is as follows: "Place both hands on the abdomen, two or three inches apart, and with the two fore-fingers parallel to each other; then, while the hands are still in this position, give slight blows or shocks on the abdominal parietes with the fore-finger of the right-hand: this will produce an undulatory motion in the effused fluid, which will be readily perceived by the fore-finger of the left-hand. The same result is obtained, if the right-hand is quite raised, provided the blows are given obliquely, as if brushing the surface."—*Piorry, du Procédé Opératoire*, p. 137.

But by far the most frequent cause of abortion is in the product of conception itself; viz. in a diseased condition of the fœtus, or its involucra, by which it is deprived of life, and afterwards expelled from the uterus like a foreign body. The blighted ovum is thrown off from the parent, as fruit which has become withered is separated from the branch of the tree on which it has been produced. We have examined numerous ova which have been prematurely expelled, and in many of these, where no disease was obvious at first, some morbid state of the membranes, placenta, or embryo itself, has been detected, sufficient to account for the accident, wholly independent of any constitutional or local affection of the mother. Sometimes the chorion has been thickened, opaque, and extremely irregular, or lobulated, on its internal surface. The amnion, in some cases, has undergone similar changes, so that the healthy appearance of the involucra has been entirely lost. A collection of serum, or blood, has not unfrequently, also, taken place, between the chorion and amnion. The placenta, in some cases of abortion after the third month, has been hard, like cartilage, small and imperfectly formed, with calcareous particles deposited in its substance: in others, the placenta has been unusually large, and its vascular structure has been changed into a soft yellow fatty substance; or hydatids have been developed in its tissue. The umbilical cord, in these instances, has been remarkably slender, and the fœtus has appeared to perish for want of a proper supply of nourishment; and not from any defect in the organization of its internal parts.

The brain of the fœtus, or the thoracic or abdominal viscera, may all undergo various alterations of structure incompatible with life; and where the life of the fœtus is extinct, it becomes an extraneous body; expulsive efforts on the part of the uterus are usually soon set up, and abortion ensus as the necessary consequence. When the ovum is healthy, it adheres to the uterus with great force; but when diseased, the slightest shock to the mother, the most trifling mental affliction, is sufficient to cause it to be expelled. Women have had the bones of the extremities fractured during pregnancy, and have suffered other grievous injuries, without miscarrying. A woman mentioned by Mauriceau escaped by a window from the third floor of her house when on fire, and in her fall to the ground fractured her arm, yet abortion did not follow. The case of a young woman with a narrow pelvis is related by Madame Lachapelle, who threw herself into a deep pit, and suffered injuries of which she subsequently died, yet the fœtus was not expelled.

All cases of abortion cannot, however, be referred to organic diseases of the uterine organs, or of the embryo and its involucra; since it cannot be doubted that the process often arises from accidental detachment of the placenta, in consequence of an unusual determination of blood to the vessels of the uterus, or contraction of its parietes. The placenta adheres to the uterus by means of the deciduous membrane alone, which is directly applied to the openings of the uterine sinuses. If the impetus of the blood in these be increased by an excited state of the general circulation, or by irritation of the uterus itself, an unusual afflux of blood to these vessels will take place, and the placenta will be forced from its connexion with the uterus, more or less extensively, by the extravasation of blood from the openings of the uterine sinuses, between the placenta and uterus. If this takes place to a considerable extent, the process of gestation will be arrested, and in a longer or shorter period the ovum will be expelled. In plethoric women, or in those who menstruate copiously, very slight causes may give rise to a hemorrhagic effort in the uterine vessels, and to the extravasation of blood between the uterus and placenta, with the other consequences now described. A plethoric state of the uterine organs is most frequently met with in those who lead luxurious lives, who sleep in warm soft beds, and indulge to excess in animal enjoyments. This plethoric state of the uterus commonly gives rise to a sense of weight in the hypogastric region, or irregular pains of the uterus; but it sometimes happens that the blood suddenly bursts from the uterine vessels, and detaches the placenta, where there has existed no previous sign of unusual determination of blood to the parts.

Besides these causes, there are others which excite undue determination of blood to the uterine organs, as violent exercise, dancing, the use of the warm bath, the employment of acrid cathartics and emetics, spontaneous diarrhœa, the irritation of hemorrhoids, injurious pressure of the hypogastrium, and violent passions of the mind. Opening the membranes of the ovum and evacuating the liquor amnii certainly gives rise to premature expulsion of the contents of the gravid uterus.

[Occasionally a habit of aborting is acquired; so that it is extremely difficult for the female to pass the period at which the accident has occurred in previous pregnancies. Cases have occurred in which it has happened upwards of twenty times in succession, about the same period of gestation.]

The symptoms which precede abortion will be greatly modified by the exciting cause. For the most part, the expulsive process is preceded by unusual depression of strength and spirits; by attacks of faintness, sense of coldness in the pelvis, palpitation, flaccidity of the breasts, a disordered state of the stomach and bowels, and other symptoms, which indicate that the embryo has been deprived of life.

Where an unusual afflux of blood to the uterus is the cause, the uterine pains or contractions are usually preceded for some days by rigours, lassitude, heat of skin, thirst, loss of appetite, excited state of the circulation, and sense of weight in the pelvis and loins. A greater or smaller quantity of blood then escapes from the uterus and vagina, with pains occurring at intervals, like the pains of natural labour. Where the discharge of blood is great, the placenta has usually been extensively detached from the uterus, and all efforts to prevent the establishment of contractions are consequently unavailing. In some cases, where a considerable hemorrhage has taken place, with irregular pains, in the early months, the hemorrhage and contractions have both been suspended by the remedies employed, and the fœtus has been retained until the full period. In no case, however, has the progress towards the complete expulsion of the ovum been averted, where the pains have recurred at regular intervals, with discharge of blood from the uterus, or a certain quantity of a dark-coloured serous fluid, with softening of the os and cervix uteri, and the formation of the bag of waters in the mouth of the uterus during the pains, have taken place. Under such circumstances, all our efforts to prevent abortion will prove wholly ineffectual.

When the embryo is dead, it is often expelled in a short period, with little pain and trifling loss of blood; in other cases the process is very protracted, continuing many days; and in some rare cases which have been reported, the ovum, after having been retained in the uterus many months, has passed through various stages of putrefaction or decomposition. The embryo may die before the end of the third month, and not be expelled till the fourth or fifth month; or a fœtus of seven or eight months may lose its vitality, and not be expelled till the full period of gestation is completed. In twin cases one fœtus may die in the latter months, and be retained until the full period, and then expelled with the living child.

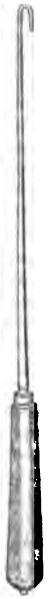
It has been supposed that the embryo may be expelled, and yet the membranes continue to adhere to the uterus, and be completely developed. The membrana decidua is said to acquire a considerable thickness, and the amnion entirely to disappear, while the cavity of the chorion gradually contracting, the mass which remains is only a red fleshy substance, in the centre of which there is sometimes visible a small serous cavity. M. Velpeau and other French pathologists have explained the formation of fleshy moles on this principle, but their opinion is not supported by satisfactory proof; for though these substances are invariably the products of conception, it is not certain that they are formed by the growth of the membranes subsequent to the death and expulsion of the embryo. In several cases of this description no embryo was at any time discharged.

Treatment.—In premature expulsion of the ovum from organic disease of the uterine organs, or from alterations of structure in the embryo or its involucra, any plan of treatment is not only inefficacious, but even injurious, where the contractions of the uterus have been excited to throw off its morbid contents. Where the symptoms of abortion come on without any apparent cause, we have reason to fear that they arise from this state of the uterus or its contents. The treatment must be directed to the following points: first, to procure a complete separation of the ovum; secondly, to moderate the hemorrhage and pain which may accompany it.

By removing plethora, where there is general fulness and excitement, by venesection, and by calming the violence of the uterine contractions by sedatives, we shall often prevent a protracted discharge of blood; and by obtaining relaxation of the os and cervix uteri, favour the complete escape of the ovum. Where there are no signs of local or general plethora and excitement, blood-letting is contra-indicated.

In threatened abortion from congestion of blood, or unusual determination of this fluid to the uterus, with slight detachment of the placenta, and irregular uterine contractions, it is possible in some cases, by the prompt application of remedies, to arrest the mischief. The greatest mental tranquillity, and absolute rest in the horizontal posture, on a mattress or couch, with the body lightly covered, should be enjoined in all cases of threatened abortion of this description. If the patient is plethoric, and the pulse accelerated, blood is immediately to be detracted, in quantity proportioned to the urgency of the symptoms. Twelve or sixteen ounces should be taken from the arm, and, if necessary, the same quantity should again be taken after a time. Cold applications, and even ice, if it can be procured, should be applied over the pubis. A dose of laudanum, or liquor opii sedativus, is to be given, or a starch and laudanum clyster may be administered, to prevent or quiet the uterine contractions. The acetate of lead is in these cases a valuable remedy. Two grains, combined with a quarter of a grain of opium, may be taken every three hours until the discharge of blood begins to abate.

[Should the flooding be excessive, the tampon should be had recourse to. This may consist of a piece of soft sponge, of sufficient size, which may be introduced in the dry state, or, lubricated with oil or melted lard. It favours the formation of a coagulum, and the consequent arrest of the hemorrhage. When any portion of the ovum is retained in the uterus, it is recommended by Dr. Dewees to employ a wire crotchet, as represented in the marginal figure, which is one-third of the proper size. It consists of a piece of steel, of the thickness of a small quill at its handle, and gradually tapered off to its other extremity, which is bent to a hook of small size. When the placenta is felt to be embraced by the neck of the uterus, the crotchet may be used in the following manner. The fore-finger of the right hand is placed within, or at the edge of the os tincæ; and with the left the hooked extremity is conducted along this finger, until it is within the uterus. It is gently carried up to the fundus, and then slowly drawn downwards, which causes the curved point to fix in the placenta. It may then be withdrawn, and the placenta with it. In every case in which Dr. Dewees used it, the discharge instantly ceased.



Dr. Bond, of Philadelphia, has contrived a forceps, with the view of supplying the acknowledged defective means, in present use, for the removal of the placenta in cases of abortion attended with uterine hemorrhage. The forceps is about ten inches long, curved laterally upon a radius of about twelve inches—the handles being four inches, and the blades about six inches in length. The blades terminate in an elliptical expansion, about an inch long, and three or four eighths of an inch wide, without any fenestra. The handles and blades, including the expanded part, are bevelled or rounded off, so as to avoid the risk of wounding or pinching any of the soft parts. Within this rounded edge, the expanded part is made very rough, so as to maintain a secure hold upon the body embraced. The forceps may be made straight; but Dr. Bond thinks, that in most cases the curved instrument will be found more convenient for the operator and easier for the patient.]

As to the subsequent effect of abortion, it may be stated as a general fact, that, in a very large proportion of cases, it produces little or no injurious effect on the constitution of the mother. It is an accident of very frequent occurrence in all countries, and has often occurred without leaving any permanent injury. Where the process of expulsion has been protracted, and much blood has drained from the uterine vessels, a proportional injurious effect has been the consequence on the general health of the mother.

From what has now been stated respecting the causes and treatment of abortion, little requires to be said as to the management of women who are habitually liable to this accident. We are in possession of no means which can either prevent or remove the numerous organic diseases of the uterine organs, and of the embryo and its involucra. Much, however, may be done to avert the danger where it arises from plethora and irritation of the uterus alone, by obviating general fulness, and taking off the suceptibility to premature contraction of the uterine fibres, by rest, mild diet, and the occasional use of anodynes. Where there is much constitutional debility present, we must adopt all the means we possess for relieving the weakness, and more particularly the cold bath, and proper diet and exercise. Warm rooms and late hours are to be avoided.

[Dr. Churchill, considers, that one of the most effective means for breaking in upon the habit is to give the uterus a long rest, by separating husband and wife for several months; and Dr. Huston places great stress on the use of opiate injections daily, with continuance in the horizontal posture. By these means, a tolerance on the part of the uterus has been acquired, which has allowed the gestation to go on until the full period.]

The practice of inducing abortion for criminal purposes has prevailed in all ages. In the early months it is extremely difficult, from the appearances in the mother, to ascertain with absolute certainty that abortion has taken place. In dysmenorrhœa there are, sometimes, membranous substances thrown off from the inner surface of the uterus which strikingly resemble the products of conception; and even if the uterine organs are examined, we shall not arrive at complete certainty on the subject. Blood-letting, acrid cathartics, diuretics and emmenagogues, cantharides, the juniperus sabina, and various local means, have been employed to excite premature expulsion of the embryo. By the Ellenborough Act, passed in 1803, it was ordained in this country, "that if any person shall wilfully administer, or cause to be administered, any medicine, drug, or other substance or thing whatsoever, or use, or cause to be used or employed, any instrument, &c., with intent to procure the miscarriage of any woman not being, or not being proved to be, quick with child, at the time of committing such thing, or using such means, then, and in every such case, the person so offending, their counsellers, aiders, and abettors, shall be and are declared guilty of felony, and shall be liable to be fined, imprisoned, set in and upon the pillory, publicly or privately whipped, or transported beyond the sea for any term not exceeding fourteen years." The same act ordains that administering medicines, drugs, &c., with the intent to procure abortion, after quickening, shall be punishable with death.

[The absurd distinction between *quick* and *not quick* with child, which is still adhered to in the laws of some of the States, has been abandoned in England, in a more recent statute—1 Victoria, cap. 85. The following is the law as it now stands: "And be it enacted, that whosoever, with intent to procure the miscarriage of any woman, shall unlawfully administer to her, or cause to be taken by her, any poison or other noxious thing, or shall unlawfully use any instrument, or other means whatsoever, with the like intent, shall be guilty of felony, and being convicted thereof, shall be liable, at the discretion of the court, to be transported beyond the seas for the term of his or her natural life, or for any term not less than 15 years, or to be imprisoned for any term not exceeding 3 years."]

Robert Lee.

ABSCESS, Internal.—The term *abscess* (derived from *abscedo*, to depart, denoting that parts which were in contact have become separated) implies, in its pathological sense, a collection of pus in any of the tissues or organs of the body. The doctrines of suppuration will be fully discussed in the article Inflammation: in the present we shall consider the subject of *internal abscess*, including what are termed purulent formations.

I. OF THE VARIOUS MODES IN WHICH PURULENT FORMATIONS TAKE PLACE.

The theory of suppuration, or the process by which the secretion of pus from an inflamed surface takes place, is, that the purulent fluid is separated from the blood by a peculiar action of the vessels of the inflamed part, of the precise nature of which we are ignorant.

When purulent matter is confined, and not infiltrated through the structure of an organ, it constitutes, in strict medical language, an *abscess*, the boundary of which is formed either by the tissue of the organ itself, or by what is called an *accidental* tissue. In both cases the formation of the boundary is accomplished by the same means, viz.: the effusion of coagulable lymph, which, in the former, produces the union and consolidation of the tissue of the organ in immediate contact with the pus, and thus prevents its diffusion; in the latter, it forms a more or less perfect membrane over the whole of the surface from which the purulent secretion had taken place, and hence, the pus being enclosed, as if in a shut sac, is said to be encysted. It is to collections of purulent matter of the latter kind only, that the term encysted abscess is applied.

It would appear that the cysts of abscesses have the property of secreting as well as of absorbing surfaces, from the circumstance of an encysted abscess being often speedily filled after the pus has been evacuated, and that abscesses do occasionally disappear without any external opening; the only inference in such cases being, that the pus has been absorbed.

In most instances, the structure of the tissue surrounding a purulent collection exhibits evident marks of alteration. There is, in general, vascular turgescence; sometimes softening; while, in the part occupied by the abscess, the proper substance of the organ has disappeared, its place being supplied by cellular tissue, in which the pus is deposited.

Purulent collections are not always, however, bounded by adhesive inflammation or by a cyst, the pus as it is secreted being in many instances diffused through the tissue of the organ. Such infiltrations of pus happen more frequently in the lungs than in any other organ, and, till lately, were confounded with pulmonary abscess, which very rarely occurs. In most instances the formation of pus which constitutes these infiltrations is preceded by inflammation of the organ in which they are found, but in others it would appear, as we shall presently explain, that the matter is deposited by the blood in healthy structures.

Another form of purulent collections is when pus is formed in natural cavities. Serous membranes not unfrequently assume a suppurative action as a consequence of inflammation, and in this way large accumulations of puriform fluid take place in the cavity of the thorax, in the abdomen, and in the interior of the large joints.

The fluid effused varies in colour and consistence according as it is the product of acute or chronic inflammation. If it is the result of acute inflammation, it is of a pale yellow or straw colour, transparent, or more frequently turbid, from admixture of small portions of coagulable lymph, giving the fluid very much the appearance of unstrained whey; when it occurs after chronic inflammation, the fluid is not only more abundant, but also more turbid, from the greater quantity of purulent flakes with which it is mixed, and which are often deposited in such abundance as to give the effusion very much the appearance of common pus. These puriform fragments fall to the most depending part of the cavity, so that the upper portion of the fluid is of a thinner consistence than the under or more depending. The portions of the inflamed membrane are covered with an exudation of coagulable lymph, which, when recent, is easily detached; and when this new formation has become vascular, it is changed into a new structure, to which the term *false membrane* has been given.

We have hitherto been considering the formation of pus as the consequence of previous inflammation of the structure in which it is found. It is necessary, however, to point out, that pus is occasionally deposited in parts which exhibit no traces of the existence of antecedent inflammation. This fact has been long known to pathologists. Mr. John Hunter was acquainted with the occurrence of these non-inflammatory purulent deposits, as appears from the chapter in his work on Inflammation, entitled, "Collections of Matter without Inflammation," and since that time the fact has been noticed by various writers both in this and in other countries.

Though Mr. Hunter states that there is often swelling, or thickening of parts, without the visible or common symptoms of inflammation, and that there are collections of matter somewhat similar to suppuration which do not arise in consequence of common inflammation, he does not appear to favour the doctrine of the possibility of pus being absorbed into the blood, and afterwards deposited in another part of the body; but to regard all such collections of matter as of a scrofulous nature, and different from true suppuration. It is also evident that Mr. Hunter had only observed these purulent depositions in external structures. Subsequent observations however have proved that they also take place both in internal organs and in the different cavities, though there be no evidence of inflammation having previously existed.

It is the opinion of Andral and other pathologists that these purulent deposits are the results of absorption of pus, and that the pus, after it is absorbed from the suppurating cavity, is separated from the blood on the surface or in the interior of the various organs. Andral seems also inclined to think that pus is much more readily formed in some persons than in others; in fact, that there is in some individuals what may be termed a purulent diathesis.

These depositions of pus succeed most frequently to injuries and surgical operations. They are by no means however confined to these cases; for instance, they are not uncommon after phlebitis, or in fatal cases of puerperal peritonitis, and in inflammation of the uterus. They also occasionally, though rarely, occur after continued fever and erysipelas.

There are few tissues in which these non-inflammatory purulent deposits have not been found. They form in the brain, in the cavity of the thorax and abdomen, in the muscular tissue of the heart, in the parenchyma of the lungs, liver, and spleen, in the substance of the uterus, in the ovaria, in the external cellular membrane, and in the joints.

II. ABSCESS IN PARTICULAR TISSUES.

Although there is no structure in the human body, if the epidermis, nails, and hair be excepted, which does not occasionally become inflamed, yet abscess does not form in every tissue; a particular kind of structure being apparently necessary to its formation. For instance, it cannot take place in the dense structure of fibrous or cartilaginous tissue, nor in that of serous membranes. When pus is discharged from these tissues, it is effused, either upon their surfaces, or into the cavities which they invest; but abscess never forms in their proper substance.

It would appear that abscess occurs in those organs only into which cellular membrane enters as one of their constituents: of all the structures of the body, cellular membrane is that in which abscess most frequently takes place. It forms more frequently in superficial than in deep-seated cellular tissue; this depends not on the principle that there is a greater inherent disposition in superficial cellular membrane to assume inflammatory action, but that from its position it is more likely to be exposed to the exciting causes of inflammation than that which is deep-seated.

Pus occasionally forms in muscular structure; in those cases it is deposited in the intermuscular cellular tissue, the muscular fibre itself being apparently incapable of assuming the suppurative action.

Purulent matter has been found in all the parenchymatous tissues, either in the form of abscess or of purulent infiltration; as, for instance, in the lungs, in the liver, in the spleen, pancreas, and in the kidneys. The encysted abscess is more common in the liver; the purulent infiltration in the other organs.

With regard to abscess in nervous tissue, Andral remarks, "It is a question which yet remains to be decided, whether, when the nervous tissue is in a state of suppuration, the pus is furnished by the nervous tissue itself, or by the cellular membrane which enters into its composition. It is, however, certain, that in some cases of abscess of the brain we find in the seat of suppuration nothing but a congeries of cellular tissue, which, in all probability, is the only source from whence the pus is derived, inasmuch as the nervous tissue has completely disappeared. Certain white softenings of the brain have been regarded by some authors as the effect of a purulent infiltration of the nervous tissue. This is a mere gratuitous hypothesis; there is no proof whatever of the presence of pus in these cases of softening: all that the most minute examination can detect is a diminution in the consistence of the nervous tissue, which in those cases appears to manifest a disposition to return to its original state." (Vol. i. p. 498, *Translation.*)

In alluding to purulent effusions in the cavities which are lined with serous membranes, we stated that pus is frequently secreted by serous tissue in a state of inflammation.

Mucous membranes, however, take on the suppurative action more easily than the serous. From the extent of this structure in the animal economy, suppurative inflammation of mucous membranes is by no means uncommon. It occurs, for instance, in the bronchial membrane; in the mucous lining of the kidney, bladder, and urethra; in those shut cavities which are lined with mucous membrane, as in the maxillary and frontal sinuses; in the cavity of the tympanum, and in the æthmoidal cells. There is an important difference in the inflammation of serous and mucous membranes—the former are very liable to *adhesive* inflammation, which it is hardly possible to excite in mucous membranes.

Lastly, pus has been found in the vascular system, even in the blood itself. It has been detected in the veins which return the blood from parts in which pus has been collected; and also in inflamed veins from puncture or after operations.

The lymphatic vessels frequently contain pus, as, for instance, when they originate in textures which are in a state of suppuration.

III. Of purulent Formation in Organs.

1. Abscess in the Brain.—The brain is not unfrequently the seat of purulent deposits—the pus being, in some cases, infiltrated through its substance; in others, collected in distinct cavities of different sizes. Sometimes several small abscesses unite so as to form a large cavity.

According to Andral, in the primary stage of cerebral abscess, small drops of pus are seen scattered, in greater or less numbers, through a portion of the nervous substance, which is, at the same time, generally injected and softened. These drops gradually multiply, extend, and run into one another; the solid parts between them grow softer and softer, and at last appear dissolved, as it were, in the pus, leaving only a few filamentous fragments behind. We have, then, a cavity, which however does not become distinctly circumscribed till some time afterwards. When the parietes of this cavity first become distinctly marked, they consist merely of the nervous substance itself; but, subsequently, we observe on their surface, in succession, *first*, a cellulo-vascular substance, either spread uniformly over their whole extent, or existing only in small isolated points: *secondly*, a real membrane, which, however, is still soft, flocculent, and separable from this nervous substance: *thirdly*, a membrane of more firm consistence and distinct organization, which is sufficiently tenacious to be detached, either in shreds, or in a single piece, from the subjacent tissue. (Vol. ii. p. 770.)

The portion of the brain surrounding the abscess is generally softened, when it is recent; but when it has existed for some time, the structure in the immediate vicinity is very liable to become inflamed, and to undergo various morbid alterations consequent to inflammatory action.

When the abscess is situated near the ventricles, the purulent matter may force its way into them, from the slow and progressive destruction of the cerebral substance. When it is nearer the surface, it generally extends outwards, and then bursts between the membranes.

In those cases in which the cerebral abscess is situated near the internal ear, the diseased action sometimes extends to the bony structure of this organ, destroying, first, the dura mater, and afterwards the petrous portion of the temporal bone. In this way the contents of an abscess in the brain have been discharged through the ear. In other instances the disease commences in the ear, and spreads to the membranes and substance of the brain. On dissection of such cases pus is found in the internal ear; the dura mater is softened and detached from the inner table of the skull; the brain softened, and either infiltrated with pus, or containing an abscess. Several interesting cases of this kind are recorded in the works of Lallemand, Itard, Abercrombie, and others, to which the reader is referred.

Cerebral abscess has been known in some instances to terminate, also, in destruction of the cribriform plate of the æthmoidal bone; and in this way the matter has been discharged through the nasal fossæ.

Purulent collections are occasionally found in the cerebellum. It has been remarked as diagnostic of these latter cases, that the mental powers are little, if at all, impaired; hence the symptoms of this lesion are very obscure and unsatisfactory. Andral states that in one solitary instance the tubercula quadrigemina and pineal gland were found completely destroyed, and their place occupied by an abscess.

From the structure of the medulla spinalis being precisely similar to that of the brain, this portion of the cerebral organization is liable to the same morbid changes. It has been found, in some instances, infiltrated with pus; but there is no recorded case of abscess in its substance. Dr. Carswell met with a case of abscess of the spinal marrow, in a woman of 45 years of age, a patient of Mons. Louis, and the particulars of which were furnished him by Mons. Reynaud. The pus occupied the cortical substance of the right anterior half of the spinal marrow, formed a cylindroid abscess nearly five inches in length, and, in some parts, more than a line in diameter. A similar collection existed in the left anterior half, and was likewise limited to the situation of the cortical substance; but it was not more than an inch in length, and terminated in the former, about an inch and a half above the primary seat of the inflammation.

With regard to the progress of cases of cerebral abscess, it would appear, from the symptoms exhibited previous to the deposition of pus, that inflammation of the membranes or substance of the brain always precedes the formation of matter; that after the deposition of pus the inflammatory action ceases, the symptoms diminish, and the functions of the brain are in part or entirely restored, notwithstanding the presence of such a foreign body as an abscess. The disease may then lie dormant for a considerable time, till the portion of the brain immediately in contact with the abscess takes on inflammatory action, and then the features of the malady again indicate inflammation of the brain, of a more or less acute character, which generally proves fatal; death being caused, not by the abscess, but by the inflammation which supervenes. It must be admitted that, in investigating the history of several recorded cases of abscess of the brain, we find the train of symptoms very obscure and unsatisfactory.

2. **Abscess in the Interior of the Mouth and Pharynx.**—The tongue is liable to inflammation and its consequences. Abscess in its substance, however, is a very rare occurrence. Though Andral alludes to it after acute inflammation, we have not been able to find an instance on record.

Abscess frequently succeeds to inflammation of the tonsils and pharynx. The cellular tissue which surrounds the amygdalæ is very liable to inflammation, which occasionally terminates in suppuration, the matter being discharged into the mouth. When the abscess is large, there is great danger of suffocation from the pressure of the swelling on the glottis. Such abscesses sometimes form in the progress of acute diseases, more particularly fever, and the acute eruptive disorders of children, and give rise to all the symptoms of croup. If the tumour can be discovered, it should be opened by puncture; indeed, in some instances of this kind, promptitude is necessary to save the patient's life.

When an abscess occurs in the pharynx, it is apt to be overlooked, because, from its situation, it cannot be easily seen. When it is suspected, the finger should be carried down the pharynx, and, if necessary, the tumour opened, as death has occasionally occurred from its pressure on the glottis. This has occasionally happened in fever and acute eruptive diseases.

Abscess in the cellular tissue connecting the mucous membrane with the muscular tissue of the œsophagus occasionally takes place, and gives rise to dysphagia, more or less urgent according to the extent of the purulent formation. When such abscesses attain a large size, they not only impede deglutition, but, by pressing on the trachea or lungs, produce considerable cough and difficulty of breathing.

It is often very difficult to distinguish abscess from stricture of the œsophagus. In some instances, on the introduction of the probang, in order to ascertain the cause of dysphagia, the true nature of the disease has been ascertained by the rupture of an abscess, and the discharge of pus from the œsophagus.

Adhesive inflammation sometimes takes place between abscess of the œsophagus and the adjoining structures. In this way an abscess of the œsophagus, by adhering to the lung, has been discharged through the bronchial tubes.

3. **Purulent Formations in the Chest.**—1. Purulent effusion into the cavity of the chest is not unfrequently the termination of pleurisy, particularly of the chronic form, and constitutes the disease termed empyema, which it is evident can only be considered as a secondary affection.

The character of the fluid effused into the sac of the pleura differs according as it arises from acute or chronic pleurisy. When it succeeds to the former, it is of a pale yellow or straw colour, and generally a little turbid from being mixed with the coagulable lymph which is secreted by the inflamed pleura. In chronic pleurisy, the fluid is not only in larger quantity, but of a consistence approaching to that of common pus, and generally mixed with masses of coagulable lymph.

As pleurisy seldom takes place in both sides of the chest at the same time, effusion is generally observed in one cavity only. The fluid is sometimes very rapidly secreted; in other instances it takes place slowly and insidiously, the lung on the diseased side being compressed and pushed towards the upper part of the chest, in which situation it is often retained by adhesions. The lung is sometimes so reduced in size as to be scarcely more than four to six lines thick, even in its middle, and without careful examination might be considered to be totally destroyed.

Sometimes a tubercle in the stage of softening, when situated near the pleural lining of the lung, bursts into the cavity of the chest. Pneumo-thorax immediately follows; this is succeeded by inflammation of the pleura, and rapid effusion, which proves fatal in a very short time. In some cases, however, adhesive inflammation takes place between the pleura pulmonalis covering the tubercle and the walls of the thorax; and thus the contents of the tubercular cavity are prevented from escaping into the sac of the pleura. In other instances, the adhesive inflammation extends to the parietes of the thorax, and in this way tubercular matter escapes through a perforation in the chest. (*See* Pneumo-Thorax *and* Tubercle.)

Abscess of the liver or spleen occasionally bursts into the cavity of the pleura, and induces inflammation of the pleura and purulent effusion.

2. Abscess of the lung is a lesion very rarely met with, though from the frequent mention made of this pathological phenomenon by British as well as by some continental writers, we should be led to imagine it was a common termination of pulmonary inflammation. The opinion of Laennec on this point is very strongly expressed. It appears from his statement, that there is no organic lesion more rare than a collection of pus in the substance of the lung; and that, among several hundred dissections of persons who died of peripneumony, he had only met with a collection of pus in five or six instances, and in these purulent deposits were neither extensive nor numerous in the same lung. In three cases only was the collection of pus of considerable extent, but in these there was no circumscribed cyst, the wall being formed by the pulmonary tissue, which was much softened and disorganized. Laennec also states that he had been able to find only two similar

cases on record, neither of which had the proper cyst of phlegmonous abscess.

Andral mentions the case of a new-born infant, whose lung contained several large abscesses. They had no resemblance whatever to tubercular excavation. (Vol. ii. p. 539, *Translation.*)

3. The kind of suppuration to which the substance of the lung is occasionally liable is purulent infiltration. When it occurs, it is accompanied with hepatization, and appears to succeed to the most intense degree of inflammation. The consistence of the lung is at the same time much diminished, being so soft as to break down when handled. The pus appears in small detached points, so that when the lung is incised or squeezed, opaque yellow matter flows out. It may occupy an entire lobe, or only a small portion of it, and sometimes succeeds to pneumonia with great rapidity. Andral asserts that it has been found fully formed four days after the first symptoms of pneumonia had made their appearance.

The pulmonary parenchyma when infiltrated with pus presents a greyish ash colour, and, as the second stage of pneumonia has received the name of *red hepatization*, the former condition has been distinguished by the term *grey hepatization.* When the lung, in this state, is pressed, the purulent fluid exudes in greater or less quantity, and when it is squeezed out, the lung frequently reassumes the red colour and hepatized appearance of the second stage; thus proving, as Andral states, that the *grey* hepatization differs only from the *red* in having its structure infiltrated with pus.

4. The process of softening of tubercles presents another variety of purulent formation in the substance of the lung. These bodies, which vary in size, are in their first stage semi-transparent, and of a greyish colour; in some cases almost colourless and transparent. In this state they are productive of little inconvenience; and hence individuals, with pulmonary tubercles, often enjoy uninterrupted health for years. Sometimes a single tubercle has been found, but more generally they are numerous, and situated in the upper part of the lung. In some cases they are superficial, in others deep-seated. The tendency of these bodies is to soften, and to form a cavity in the portion of the lung where they are situated. The softening generally commences in the centre, and gradually increases towards the circumference, until the whole tubercle is converted into a fluid mass. One or more of the bronchial tubes become perforated, through which the tubercular matter is evacuated. A tubercular cavity is thus left, the interior of which is traversed by bands of pulmonary tissue, covered by tubercular matter, and the smaller branches of blood-vessels, which are generally obliterated and transformed into impermeable cords. In some instances, however, these vessels continue open, and, by their erosion or rupture, occasion hæmoptysis. The larger blood-vessels are pressed towards the side of the excavation, lining, as it were, its internal surface. The bronchial ramifications undergo similar pressure; but, according to Laennec, they appear to be rather enveloped than pressed aside by the tubercular matter, the pressure apparently soon obliterating their canal, as they are scarcely ever to be detected in the morbid structure of the lung. He moreover thinks they must have originally traversed the portion of lung occupied by the tubercles, as, in even the smallest excavation, one or more bronchial tubes are found opening into it. These tubes appear not to open sideways, but are cut directly across on a line with the internal surface of the excavation, while from their direction, it is evident that they originally crossed the excavation. The boundary of these tubercular cavities is formed by the parenchymatous tissue of the lung, which has become more or less indurated or infiltrated with tubercular matter. The internal surface is lined by a false membrane, which is composed of concrete pus, and is so soft as to be easily detached by the scalpel.

These cavities vary in number and size; sometimes there is only one cavity, in others there are several, which either remain isolated, or communicate together by fistulous openings, varying in extent from such as will scarcely contain a filbert, to those which occupy a considerable portion of one lung.

With regard to the possibility of the cicatrization, or healing of tubercular excavations, it would appear, from the minute and distinct researches of Laennec, that this process does take place, though in a very small proportion of cases. For a minute account of the stages of this reparative process, we beg to refer to the work of Laennec, and to the article TUBERCLE.

5. Besides the sero-purulent effusion into the pericardium (from *pericarditis,*) abscess has been found in the muscular structure of the heart itself. The abscess is not encysted, the pus being diffused in the cellular tissue, connecting its muscular fibres; and in all the instances recorded, it appears that the previous inflammation had been confined to the portion of the structure of this organ in which the abscess occurred. The substance around the abscess is stated, in some cases, to have been natural; in others, it appeared red and softened.

Abscess of the heart, however, is a lesion very rarely met with, although frequent allusion to such cases is made by the older writers, who, no doubt, mistook the sero-purulent effusion into the pericardium for abscess. There are, however, on record several well-authenticated instances of true cardiac abscess.

Laennec mentions the case of a man, sixty years of age, in whom he found an albuminous exudation of the consistence of boiled white of egg, and of the colour of pus, deposited among the muscular fibres of the left ventricle. The symptoms before death (orthopnœa and indescribable anguish) indicated acute inflammation of some of the thoracic viscera. He alludes to another case, in a child twelve years of age, in whom he found an abscess of the size of a filbert in the left ventricle. This case was complicated with pericarditis. A similar instance is mentioned by Andral; (vol. ii. p. 345.)

In a fatal case of phlebitis after venesection, which occurred at Bethlehem Hospital, Mr. Lawrence found, in addition to the disease of the brachial veins, pericarditis, with deposition of pus in the muscular substance of the left ventricle, which was also softened and partially broken down. (*Med. Chir. Trans.*, vol. xv., p. 124.)

4. Purulent Formations in the Abdomen.—1. In treating of the different modes in which purulent matter is deposited in natural cavities, we alluded to the suppurative inflammation of serous membranes. We have already observed that the secretion of puriform fluid is not an infrequent termination of chronic pleurisy. The same thing happens in peritonitis, in fatal cases of which more or less sero-purulent effusion is found in the abdominal cavity. The consistence and quality of this fluid vary according to the duration of the disease; and hence, from the character of the effusion alone, its duration may, in most instances, be inferred. In some instances, circumscribed cavities, containing puriform fluid, are found. These originate in cases of partial or circumscribed peritonitis, the boundary of the cavity being formed by the effusion of coagulable lymph, by which the convolutions of the intestines become agglutinated. In other cases, purulent effusion into the abdomen has been the consequence of the bursting of an abscess in some of the abdominal viscera—the liver, for instance—or of intestinal perforation. These intestinal perforations may occur in any portion of the alimentary canal, but most frequently take place in the small intestines, and are generally the consequence of follicular ulceration and progressive destruction of the muscular and peritoneal tunics. When the peritoneal coat gives way, the intestinal contents escape into the cavity of the belly, and rapid inflammation, followed by death, is the almost invariable result.

In some cases, the adhesion of the bowel to some adjacent part has prevented the intestinal perforation. In a remarkable case of this kind, the abscess communicated with the caput coli, to which, and to the parietes of the abdomen, the omentum had contracted a very firm adhesion. In this manner a circumscribed cavity was formed, bounded by this portion of omentum, the posterior surface of the caput coli, and the portion of peritoneum lining the parietes at the part. This cavity contained a small quantity of ill-conditioned pus, and three or four bodies which appeared to be the seeds of fruit covered by earthy incrustation. It communicated with the caput coli by a small irregular opening, the mucous membrane around which was thickened and vascular. (*Abercrombie, p.* 338.)

2. Abscess of the liver is not very common in temperate countries, but is a very frequent termination of hepatitis in warm climates. The pus may be either infiltrated through the substance of the liver, or may be contained in a cyst, forming the encysted hepatic abscess.

Abscesses of this organ vary in extent, being sometimes very small, in other cases of a large size, not less than three to four pounds of purulent matter having been found in a single abscess. (*Abercrombie.*) They differ, also, in number: there may be one abscess only, or there may be several, which are either perfectly distinct from each other, or communicate by fistulous openings. Hepatic abscess, when of small extent, may be absorbed; more generally, however, adhesive inflammation takes place between the walls of the abscess and some of the surrounding structures. In this way the pus may be evacuated externally through the parietes of the abdomen; into the right pleural cavity; through the diaphragm; or, should adhesion have taken place between the liver, diaphragm, and parenchyma of the lungs, the contents of the abscess may be coughed up through an opening in the bronchi, and the patient may eventually recover. In other instances, the abscess forms adhesion to some contiguous portion of the alimentary canal, into which the pus is evacuated and discharged, either by vomiting, should the abscess adhere to the stomach, or by stool, if the adhesion takes place to the alimentary canal. In a case related by Malpighi, in which the abscess was situated near the gall-bladder, adhesion took place, and the contents were discharged through the biliary duct into the bowels. Andral alludes to a case in which an abscess of the liver communicated with the interior of the vena cava, and to another in which it opened into the pericardium. (Vol. ii. p. 598.)

3. The termination of inflammation of the spleen in abscess is uncommon; indeed, idiopathic inflammation of this organ is a very rare disease. Purulent infiltration in the spleen, however, often takes place at the same time that pus is deposited in other parenchymatous structures. In these cases, it is probable that the pus is formed elsewhere, and only deposited in the spleen through the medium of the circulation.

Andral mentions the case of a woman, in whom, on dissection, he found a number of small abscesses in the spleen, lungs, liver, and brain; the uterus, however, was the organ in which the pus was originally formed; for the symptoms of inflammation of the uterus were those which appeared first; and in the substance of this organ there were several collections of purulent matter, while all the uterine veins were filled with pus.

The pus, in abscess of the spleen, may be diffused through the parenchyma of the organ, or it may be confined in a cyst of variable extent. The structure surrounding the abscess is sometimes unchanged; more generally, however, it is softened and considerably altered in its texture, so as to be pulpy and easily broken down. These abscesses often attain an extraordinary size. In a case recorded in the Memoirs of the Academy of Sciences, an abscess of the spleen contained thirty pounds of purulent matter. In another mentioned in the same work, eight pounds of matter were drawn off by tapping. The patient died next day, and the spleen was found still to contain seven pounds of pus, the sac of the abscess being eighteen inches in length and twelve in diameter.

Like abscesses of the liver, those of the spleen, by forming adhesion to some adjoining viscus, may burst into the cavity of the pleura, (*Tweedie*, Clinical Illustrations of Fever,) stomach, (*Coze*, Journ. de Méd. tom. 82,) colon, (*Jacquinelle*, Journ. de Méd. tom. 88); or, by the cyst of the abscess forming adhesion to the kidney, the pus may be discharged with the urine. The matter may be, also, extravasated into the cavity of the belly, in which case it proves rapidly fatal; or the abscess may form an external tumour in the left hypochondrium, and in this way the matter may be discharged externally, by an opening in the abdominal parietes.

Among the lesions observed in the spleen in fatal cases of fever, abscess may be enumerated. Though rather uncommon, cases of this kind have been recorded. Mr. Wardrop states, in a note to Baillie's Morbid Anatomy, that in some of the British soldiers who suffered from the Walcheren fever, and who afterwards died in this country, the whole substance of the spleen was converted into a puriform fluid, contained in its proper capsule.

4. The pancreas is very rarely diseased, alterations of structure being less frequently observed in this than in any other organ of the body. Several cases of pancreatic abscess, however, have been recorded. Baillie mentions one case of it: the abscess contained a considerable quantity of thin pus; the pancreas being much enlarged in size. Portal mentions having met with several instances; and Andral once found two abscesses imbedded in the structure of the pancreas, each of which might have held a hazel nut. In a case mentioned by Dr. Percival, in which there was jaundice with bilious vomiting, epigastric tumour with discharges of blood and fetid pus by stool, the pancreas was found greatly enlarged, and contained a large abscess, the ductus communis being obliterated by pressure.

5. The intestinal absorbents occasionally suppurate, the pus being either collected in a cyst, (the parenchyma of the gland being destroyed,) or diffused through their structure. In scrofulous children, in whom mesenteric disease is more frequently met with than in adults, these glands are enlarged, and when cut into are found to contain soft curdy matter intermixed with pus.

6. Abscess is a common termination of inflammation of the kidney. Renal abscesses are generally small; they are sometimes, however, of considerable size, and lined with a soft membranous layer. Purulent infiltration of the kidney has also been observed, co-existing with purulent collections in other organs. The abscess, again, may be exterior to the kidney, in the cellular tissue in which this organ is imbedded. The pus formed in renal abscess in general passes through the ureters into the bladder, and is then expelled with the urine. Adhesive inflammation may, however, take place between the wall of the abscess and the parietes of the abdomen, and a communication has thus been formed between nephritic abscess and the loins. In some rare instances the abscess has burst into the colon, and the contents have been discharged by stool. A case of this kind is mentioned by Lassus.

It should be remembered, however, that when puriform matter is passed with the urine, it is not always from abscess of the kidney. The mucous membrane lining the pelvis and ureters, or the bladder, occasionally becomes inflamed, and afterwards assumes, like other mucous membranes, a suppurative action. It is impossible during life to distinguish the one class of cases from the other; nor is this of much practical importance, since the treatment is precisely the same in both.

7. Abscess occasionally forms in the muscular structure of the uterus, either in a circumscribed cyst, or infiltrated through its substance. In these cases, the uterine and hypogastric veins often contain pus, and it is by no means uncommon, as has been already stated, to find purulent deposits, at the same time, in other organs. When pus is found in the uterine veins, the prevailing opinion among pathologists is, that it is the result of uterine phlebitis, and that the pus which is found in other organs is deposited by the blood in its passage from the uterus through the various parts of the system. Pus may also be collected in the cavity of the uterus and Fallopian tubes. Dr. Carswell met with one case in which the pus collected in the cavity of the uterus was prevented from escaping by the presence of a false membrane, which passed across the orifice of the neck of the uterus.

8. Though abscess be an occasional termination of ovarial inflammation, it is by no means common. There are several examples, however, on record, of ovarial abscess which varied much in size. In a case which lately occurred to the writer of this article, (the prominent symptoms of which were uncontrollable vomiting and sympathetic fever,) the ovarial abscess was of the size of an orange. They sometimes attain an enormous size; as in a case related in the North American Medical and Surgical Journal for 1826. A woman had an abdominal tumour which was imagined to be ovarial dropsy. Its real nature was only discovered after death, when the tumour was found to be a sac, containing twenty pints of well-formed pus.

In some cases, the capsule of ovarial abscess has burst, and the pus has been extravasated into the cavity of the belly. An interesting case of this kind is related by Dr. Seymour, in his work on Diseases of the Ovaria. In this case, the young woman, after suffering some time from hectic fever, (the cause of which was not very apparent,) suddenly complained of most acute pain over the abdomen, and in a few hours expired. On opening the body, the cause of death was apparent. A large quantity of pus was effused into the peritoneal cavity, which had escaped from an abscess in the right ovary.

The ovarial abscess sometimes adheres to an adjacent organ, either to the uterus, vagina, bladder, or to some portion of intestine. In these cases, the pus is discharged eventually into the viscus to which the abscess adheres.

Lassus mentions the case of a woman who had long suffered from pain in the right lumbar region, supposed to proceed from suppuration of the kidney, because pus was voided with the urine. After death, the right kidney was found in its natural state, but there was an abscess in the right ovarium, which was adherent to the bladder, into which the pus had passed through an ulcerated communication. Andral met with a similar communication between one of the ovaries and the bladder in a young woman, who died thirty-seven days after her confinement.

A. Tweedie.

ABSTINENCE. By this term is meant the excessive or total privation of food.

The animal frame is described by M. Cuvier as a *tourbillon*, by which substances are continually taken from without, carried into the circulation, deposited, re-absorbed, and finally rejected. The mass both of the fluids and of the solids is thus supplied, repaired, or renewed. If our object be to diminish this mass, abstinence affords us, not the most prompt, but the most permanent and natural remedy.

Not the mass only, but the sentient and moving powers of the system are diminished by the privation of food; and this both in regard to animal and organic life, to use the useful and expressive terms of Bichat; so that if our further object be to reduce the powers of the system, abstinence still furnishes us with the most simple and direct remedy.

The ancient physicians were so impressed with the importance of various modifications of diet in the treatment of diseases, that they divided the whole art of physic into dietetics, pharmaceutics, and surgery. (See *Celsus, præf.*) And, in regard to the employment of abstinence, the rules of Hippocrates for the treatment of a patient affected with varix or aneurism are precisely the same as those of Valsalva; that is, *dieta quâ quam siccisimus et exsanguissimus fiat.* (*De Morbis*, lib. i. sec. x.)

Man is thus sometimes subjected to the effects of abstinence by the prescription of the physician. Those effects are sometimes carried to the last extremity by accident or calamity; sometimes by obstruction in the œsophagus; and sometimes by the phrensy or monomania of the patient. In these several cases, we have, therefore, the opportunity presented to us of observing the effects of the privation of food on the human subject. The investigation has been made still more complete, by experiments upon the lower animals. (See *Recherches sur la Digestion, par Tiedemann et Gmelin*, pp. 91, 160.) In order that we may give as practical and useful a view of this subject as possible, we shall treat of it under three heads: —1. *Of the curative effects.* 2. Of the morbid *effects of abstinence* employed as a remedy. 3. *Of the morbid* effects of famine in the other cases *to which* we have alluded; and, lastly, of the proper mode of treatment.

Curative Effects of Abstinence.—Rigid abstinence is a most powerful remedy in all acute diseases. It should, in such cases, be carried far beyond the degree prescribed as a part of the antiphlogistic regimen; the object being not so much to avoid stimulus, as to induce actual lowness, to subdue the powers of the system.

Abstinence is also a valuable remedy in many of the more chronic forms of disease: a state of extreme inanition of the stomach not only enfeebles the circulation, but acts most powerfully upon the absorbent system. With this view it has been proposed to institute a system of rigid abstinence in cancer: it might probably be more successful in some kinds of dropsy.

An obvious application of abstinence, as a remedy, is that made in cases of disorder or disease of the stomach itself. These affections are so constantly the effects of improper food, that, to change the diet is obviously but to remove the most usual cause. To withdraw food nearly altogether for a time would, doubtless, be to employ an actual and powerful remedy. This is so evident, and yet the facts in illustration are so few in number, that we cannot but recommend the subject for future inquiry. If a joint be morbidly affected, we enjoin the most absolute repose. The value of a well-regulated but rigorous abstinence in cases of disorder or disease of the stomach itself, and of some of the chylopoietic viscera, especially the liver, would, doubtless, be equally great. This subject has been well touched upon by Dr. J. Johnson; and the writer of this article can add his testimony to the beneficial effects of abstinence in the cure of these diseases.

It is impossible to refer to the subject of the use of abstinence as a remedy in disorders or diseases of the stomach, without recalling to our minds the services which M. Broussais has rendered to this department of medicine: the *diète absolute*, or extreme abstinence, recommended in gastritis by that author, is, assuredly, a far more natural and appropriate remedy, than the mistaken administration of drastic purges, too much employed in this country.

The next object in enjoining abstinence, is to reduce the mass of solids and of fluids. Abstinence is, therefore, the most direct remedy for plethora. This point has been ably treated of by Dr. Barlow, of Bath, in his Treatise on the Bath Waters. See the article ANTIPHLOGISTIC REGIMEN.

The case which next presses itself upon our notice, in regard to abstinence as a remedy, is that of disease, or tendency to disease, within the head. The immediate threatening of apoplexy must be treated by active blood-letting; but the remedy for the permanent disposition to this disease is the most strict abstinence. The most rigorous system of weighed or measured portions of the least nutritious and least stimulant kinds of food is to be enforced.

We must now add a few words upon the celebrated use of abstinence in diseases of the heart and arteries, in the hands of Valsalva, as described by Morgagni, (lib. ii. ep. xvii. § 30,) from the account given to him by Stancarius. Sufficient blood having been taken, Valsalva ordered the food and drink to be daily diminished, until it was reduced to half a pint of gruel in the morning, and less than half that quantity in the evening; to this water alone was added, and that in a certain measure only, medicated by the addition of quince, &c. When the patient was, in this manner, emaciated, and so debilitated that he could not raise his hand from the bed, the diet was slowly and moderately increased, so as just to maintain power enough for raising the body. In this manner these formidable diseases were cured. It is confessed, (§ 31,) that some thought the cure of Valsalva worse than their aneurism. But it was argued that that which was not done early in the disease, with the hope of cure, might become necessary during its progress, without such hope, from the incapacity for swallowing.

Having thus noticed the principal applications of abstinence in the cure of disease, we pass on to describe its morbid effects when inappropriately or improperly applied.

2. Morbid effects of abstinence.—The morbid effects of abstinence usually steal on the patient, and even the physician, imperceptibly. The excessive privation of food is unnatural, and therefore not to be borne long with impunity. If M. Broussais has, as we have stated, done much good, he has, also, been the author of much mischief. He has passed from extreme to extreme, and, in removing irritation, he has frequently induced a state of exhaustion not less painful and perilous. Interesting accounts of such events have been published by M. Barras and M. Cafort. (See the *Med. Chir. Rev. for Jan.* 1, 1831.) Still more recently the subject has been treated, at considerable length, by M. Piorry. (*Procédé Opératoire*, &c., Paris, 1830, p. 368.)

Having referred such of our readers as may desire to enter more fully into the subject for themselves, to these latest sources of information, we purpose to subjoin our own remarks. We think, in the first place, that the effects of *extreme* abstinence and its concomitant exhaustion have, generally speaking, not been understood; and, in the second, that the morbid effects of abstinence have, more frequently than is supposed, arisen from its misapplication.

The first part of the series of the effects of abstinence consists in simple debility and emaciation. The countenance becomes pale, and the expression languid; the muscles of voluntary motion become thinner and feebler; the pulse feebler and smaller. The second part of the series is different. The pulse is augmented in frequency; there is often palpitation of the heart, alternately with syncope; and there is pain of the head, or delirium; symptoms which might be mistaken, by the inexperienced or unwary, for those of increased action and power, whereas they are but the feeble flashes or glimmerings of a light ready to become extinct.

Such a transition in the effects of abstinence is frequently the consequence of an undue administration of this remedy; still more frequently, however, it arises from its inappropriate application. When cases of irritation are mistaken for those of inflammation, the morbid effects of abstinence are particularly apt to occur. The former disease neither requires nor bears the remedy; whilst, in inflammation, it is both essential to the cure of the disease and well sustained by the patient. This is a point which requires to be well investigated. The ancients, and especially Celsus, speak of a principle of encouragement in the sick which they expressed in these words — *difficultèr ferre morbum*, (lib. iii. § 3.) There is another principle not less important, — *difficultèr ferre* REMEDIA. It would be difficult to induce the morbid effects of abstinence when there is a tendency to apoplexy; but it would be very easy to do so if palpitation, or some other symptom of gastric irritation, were mistaken for disease of the heart, or for inflammation.

3. **Effects of famine.** — In order that our detail of the morbid effects of abstinence may be the more complete, we subjoin a more detailed account of the series of phenomena in those cases which have been continued to extremes.

The first case in point we extract from the recent excellent work of M. Andral. (*Précis d'Anatomie Pathologique*, tom. ii. p. 769.) A man, addicted to drunkenness, was cast into prison for theft, and reduced, at once, to a diet of bread and water. After the first week, a disorder of the intellectual faculties took place; his countenance became pale and expressive of languor, his flesh wasted, and his strength declined; his nights were sleepless; shortly afterwards there was delirium, which was mild at first, but subsequently furious. The prisoner was now allowed brandy. The cerebral symptoms disappeared, and the flesh and strength returned. The effects of abstinence and of an amelioration in the diet are so obvious in this brief case that it is full of instruction. Abstinence and excess induce *similar* symptoms and effects; a fact which cannot be too deeply impressed upon the mind of the young practitioner.

Dr. P. M. Latham's interesting account of the epidemic at the Millbank Penitentiary is full of facts which bear upon the same point. We refer our readers to it for much information. The late Dr. Gooch observes, in regard to this epidemic, that "the prisoners were suddenly put opon a diet from which animal food was almost entirely excluded. An ox's head, which weighs eight pounds, was made into soup for one hundred people, which allows one ounce and a quarter of meat to each person. After they had been living on this food for some time they lost their colour, flesh, and strength, and could not do so much work as formerly." "At length this simple debility of constitution was succeeded by various forms of disease: — they had scurvy, dysentery, diarrhœa, low fever, and, lastly, affections of the brain and nervous system." The affections, "which came on during this faded, wasted, weakened state of body, were head-ach, vertigo, delirium, convulsions, apoplexy, and even mania. When bleeding was tried, the patients fainted after losing five, four, or even fewer ounces of blood." On examination after death, "there was found increased vascularity of the brain, and sometimes fluid between its membranes and in its ventricles." (*Account of Diseases peculiar to Women*, p. 150.)

Interesting cases of abstinence are recorded, with the full detail of its symptoms, by Dr. Currie, (*Medical Reports*, Ed. 4, vol. i. p. 304,) and by Dr. Willan, (*Miscellaneous Works, by Dr. Ashby Smith*, p. 437.) To these cases we refer our readers; extracting only what will be sufficient to portray the usual character of the late symptoms in the case of inanition, and lead to the due distinction between the symptoms of disease of the nervous system, which arise from it, and those which depend upon a primary disease of the brain itself; for the case of extreme abstinence or famine affords a remarkable instance of the singular effects of exhaustion, and their similarity to those of diseases of a totally opposite nature and origin.

Dr. Currie describes the effects of inanition in a case of obstructed œsophagus, as involving the following circumstances: —

The patient's age was 68. The obstruction in swallowing gradually increased from the beginning of August, and on the 1st of November it was complete. The following plan was adopted: each morning, at eight o'clock, he had a clyster consisting of eight ounces of broth, two yolks of egg, and forty drops of laudanum; this was repeated at three p. m., and at nine p. m., with thrice the quantity of laudanum. Previously to the evening draught, a bath was used, consisting of one-fourth part of milk, and three-fourths of water, at 96°. In a few days the clysters were augmented in quantity, and eight ounces of wine were added, with an increased dose of laudanum. This plan was continued until the second of December. The rectum then ceased to retain the clysters, and their employment was relinquished. In spite of these plans the emaciation was rapid: the patient had weighed 240 lbs. when in health; on the 20th of November, he weighed 154 lbs.; and on the 25th, 149 lbs. only.

The pulse, during the month of November, was that of health; on the first of December, it became small and frequent; on the second, it was still more frequent though stronger, with delirium, and the case resembled the last stage of fever. "During this delirium, a perpetual and indistinct muttering occurred, with great restlessness and agitation; the surface and extremities were sometimes of a burning heat, sometimes clammy and cold. The eyes lost their common direction, the axis of each being turned towards the nose. In this state, however, the sensibility of the retina was not impaired, but rather increased, for he screamed out on the light of the window being admitted, to which before he had been accustomed. At this time also the sense of touch seemed more than usually acute, for he appeared disturbed with every accidental breath of air. The delirium and the derangement of vision commenced nearly together, but we observed the derangement of vision first. On the first of December he complained that he sometimes saw double; but it was not till the succeeding day that any considerable incoherence of mind was observed. The pulse became feeble and irregular on the fourth; the respiration, which had been singularly undisturbed, became laborious; the extremities grew cold; and in ninety-six hours, after all means of nutrition as well as all medicine had been abandoned, he ceased to breathe." During the first periods of this case there was little complaint of hunger or thirst; there was a stool, of a solid form, pale colour, but natural fœtor, with each fifth glyster. The spirits were even, and the nights good.

Dr. Willan's case was one of monomania. He visited the patient on the 23d of March, 1786, on the *sixty-first* day of his fast. His emaciation was *extreme*, and he laboured under great imbecility of mind; the eyes were not, however, deficient in lustre, and the voice remained clear and sound. He was directed to drink a pint of barley water, and two cups of panada, which agreed. He had a little fever in the first part of the night, but slept better than usual. On the 24th he had some mutton-tea; the pulse was small and temperate. On the 25th he took a pint of milk for breakfast; a pint of mutton-broth boiled with barley for dinner, and as much rice-milk for supper, at his own request. He had considerable cravings for food all the day. In the morning of the 26th he drank tea, and ate a great quantity of bread and butter, which he got from off the table in the nurse's absence. Some time after he became sick, and vomited once or twice without much straining. About noon he had a figured natural stool, and presently after two or three loose motions. His skin was always dry. In the evening he was apparently much better; the pulse ninety and firmer. On the 27th he took a little light bread pudding at dinner, and had two eggs for supper; he rested well and was cheerful. On the 28th he seemed better; he had not slept well, however, nor had a stool. On the 29th the scene was entirely changed; he began to lose his recollection in the preceding evening; and before midnight became quite frantic and unmanageable. His pulse was increased in frequency, with considerable heat on the skin, and tremors. He continued raving, and talking very incoherently, as he had done during the night. A strong purgative draught, and two clysters administered in the course of the day, produced but little evacuation.

He remained nearly in the same state of mind as above-mentioned, scarcely ever sleeping, and taking very little nourishment, till the 2d of April, when a considerable quantity of loose feculent matter was brought away by a clyster. Soon after he became sullen, and took no notice of what passed about him. He was removed at this time into the country, so that he was not seen again till the 6th of April. He appeared then emaciated to a greater degree, if possible, than at he first. His pulse was small and feeble, beating 120 strokes in a minute. April 7th and 8th he took whatever nourishment was offered him; knew those around him, and spoke sensibly, but faintly. On the 9th, in the morning, he died, quite exhausted.

The case of abstinence affords a beautiful illustration of the fact, that cerebral symptoms, resembling those of increased action, do also arise from the opposite state of the brain and of the system. The effects of exhaustion frequently stimulate phrenitis in adult age, and hydrocephalus in infancy, and it requires the utmost attention and sagacity to distinguish them.

4. **Mode of Treatment.**—The treatment of the morbid effects of abstinence, like the treatment of the effects of exposure to severe cold, consists principally in the cautious re-administration of the natural stimulus. All solid food must be avoided at first, and especially milk, which becomes solid in the stomach, and is more difficult of digestion than other solids from being unmasticated.

A little thickened broth should be given at intervals of four hours, and the quantity very gradually increased; and the bowels should be carefully relieved by enemata of barley-water.

No one can read the case of Dr. Willan without being impressed with the conviction that the treatment was most injudicious. To allow three pints of food,—milk, broth, and rice-milk, on the third day, after an abstinence of sixty days, was quite preposterous. One-third of this ration would have been far too much!

There is another aspect in which the effects of abstinence and their treatment may be viewed. Mr. Hunter observed, (*Animal Economy*, pp. 114, 115,) that if an animal be enfeebled by abstinence, its power of maintaining its temperature is also lessened. It occurred to the writer of this article to witness the same fact: some white mice had been neglected, and passed upwards of forty hours without food; they had become torpid and cold; by being held in a warm hand they were perfectly restored to life and activity before a morsel of food had been administered. From these facts we may deduce the inference, that to administer warmth is one of the most efficacious modes of remedying the effects of abstinence.

A third remedy is also very important. It consists in assiduous frictions. In cases of abstinence the powers of the circulation are greatly enfeebled. The most direct mode of restoring these powers, after the administration of food and warmth, is friction in the course of the venous blood. This remedy, therefore, must not be neglected.

MARSHALL HALL.

ACHOR, like most of the terms used to denote the morbid appearances presented by the skin, had no definite meaning before the time of Willan. By the word ἀχῶρες, Galen and the ancient writers who followed him understood "ulcerations peculiar to the hairy scalp, discharging, from very small pores, a viscid ichor, consequent to pustules." They were considered by them as a smaller species κηρίον, or *favus*, from which the latter only differed in exhibiting larger perforations, and in discharging humour similar in colour and consistence to Hymettian honey. Alexander Trallianus and Actuarius first distinguished the pustules from the ulcerations in which they terminate. The Arabians, simply translating Galen, described the achores and favi under the titles of alsahapha, or alsahaphati, and alsahara. By the early modern writers, achores — manantia ulcera capitis — were confounded with tinea; and in this sense the term is used even by Plenck. But, by the greater number of writers of the eighteenth century, it was separated from favus and tinea, and considered as synonymous with porrigo larvalis; of which disease, however, Bateman, as well as Biett, is of opinion that achores do not constitute the elementary form. We are disposed to think that Alibert, in distinguishing from that affection a disease, tinea *muciflua*, which had generally passed under the same name, has removed a difficulty which might have been inconvenient to pathologists, and has pointed out the disease to which the achores most properly belong.

According to the definition of Willan, "Achor is a small acuminated pustule which contains a straw-coloured matter, having the appearance and nearly the consistence of strained honey. It appears most frequently about the head, and is succeeded by a thin brown or yellowish scab." The matter contained in the pustules does not concrete and form a crust, but the pustule breaks and is succeeded by small circular ulcerations, from which a thin glutinous or oily mucous fluid exudes, sometimes in considerable quantity, and sometimes forming white or yellow scabs, more or less moist.

The achor is distinguished from the other pustules as follows: — from the *psydracium*, by being more elevated, more distinctly circumscribed, and less generally grouped and confluent; from the *favus*, by being smaller but more pointed, and by not being followed by the characteristic yellow sulphur-coloured indented scab (*deprimées en godet*) which explains and describes the term; from the *phlyzacium*, by being smaller and destitute of its elevated and inflamed circular base; and from the *varus*, (which, for reasons hereafter to be assigned, we shall include amongst the pustules) by being succeeded by a scab or ulcer instead of a tubercle.

Achor is a cutaneous affection peculiar to infancy and childhood, and constitutes the elementary form of some porriginous diseases; but at that period of life occasional eruptions of achores appear from time to time without amounting to a disease. These seem to be connected with a plethoric state of the body in general, or of the abdomen in particular, or with derangement of the alimentary canal, and frequently co-exist with a disordered state of the urine. They are most effectually both relieved and prevented by mild alterative doses of the pulvis hydrarg. cum creta, followed by small doses of rhubarb, with either soda or magnesia.

T. J. Todd.

ACNE.—By this term is understood a chronic affection of the skin, characterized by small pustules, generally distinct, having their base more or less hard and of a deep red colour, which, after the suppuration of the pustule, generally imperfect, becomes a small hard, red, circumscribed tubercle, almost indolent, suppurating or resolving always very slowly.

Among the best writers on cutaneous diseases there exists a difference of opinion as to the class to which acne most properly belongs, arising not so much from the difficulty of determining the nature of the vari, as from observing them in the different stages of their progress. Plenck, Willan, and Bateman, considering them as tubercles, have placed the diseases of acne in that class, whilst Alibert and Biett have arranged them with the pustular diseases. Any one who has observed the progress of this eruption with sufficient attention, will be disposed to coincide with the last-named authorities; for the circumscribed indurations, or tubercles, which are so constantly observed in this affection, are the consequences of pustules, and do not constitute the elementary form of the eruption.

Whilst pathologists have been divided upon the form of this eruption, another difference has arisen concerning the seat of it, whether it is a disease of the cellular texture of the corion, or peculiar to the sebaceous follicles, originating in their obstruction and inflammation. This latter cause of the pustules of acne had not escaped the observation of Willan, for he has made it the characteristic of his second species, *acne punctata;* and Alibert has also noticed the disorder of the sebaceous glands as a source of similar eruptions; but Mr. Plumbe, in describing this as constantly and exclusively the process of the formation of the pustule of acne, has given an extent to that opinion which is not borne out by fact. In justice, however to this writer, we must not withhold the following dissection of a case of acne rosacea, by Gendrin (*Histoire Anatomique des Inflammations*): "A man of fifty-five years of age, who died of an organic disease of the stomach, was, at the same time, affected with acne rosacea, which occupied the surface of the nose and almost the whole of the cheeks. The day after his death the seat of the eruption was of a bluish red colour, and incisions showed the skin to be thicker and more dense than in the natural state. On the surfaces of the incisions a number of small round red-coloured bodies were observed, which, examined by the lens, appeared to be sebaceous crypts, evidently double their natural size. On the surface of the skin were also to be observed the orifices of these crypts, more dilated than in the healthy state, from which a yellow caseous fluid might be squeezed. In the rete mucosum of Malpighi was seen a closely reticulated structure of blood-vessels, of a violet-red colour, and the corion generally was much increased in vascularity. Externally the skin was unequal and elevated by small round grains, which were felt more distinctly when a detached portion of the skin was pressed between the fingers. These bodies were produced by the developement and induration of the sebaceous follicles. The general tenacity of the skin was considerably diminished." Notwithstanding the proof apparently afforded by this dissection, we are convinced that the emphragma sebaceum is not the most common cause of the pustule of acne; for, although one sometimes finds, particularly on the face and chin, small pustules which are caused in this way, and from which, after the pus has been evacuated, a small oval body, formed of indurated sebaceous matter, may be expressed; and although a morbid accumulation of this matter is observed in several cases of acne, yet all this is far from proving that this state of the follicles is essential to this form of pustule. And, therefore, we very often see individuals whose follicles are in this state, without presenting any trace of acne; whilst, on the contrary, we see acne unaccompanied by this state of the follicles; and when they do become complicated together, we never see the infarcted follicles become true pustules of acne; for, by compressing the latter at the period of suppuration, pus is easily made to escape, and not indurated sebaceous matter. Nor is it correct to say that the seat of acne is always coincident with that of the sebaceous follicles; for, though this may be true as regards the nose and forehead, the contrary is the case in other parts where these glands most abound, as at the orifice of the meatus auditorius externus, in the axilla, or in the parts surrounding the nipple, the anus, and vulva.

Acne is a cutaneous disease which is pretty steady and constant in its character, and not like many other cutaneous affections, apt to change its elementary form for that of another, or to be frequently complicated with other eruptions; except that in one species of this complaint (acne *indurata*) the vari approach to the nature of furunculi, and in another (acne *rosacea*) there is a tendency to erythema. We have also sometimes observed acne upon the face to co-exist with eczema, particularly of the extremities, the hands or legs.

The opinion which we hold of the nature of the elementary eruption of acne will lead us to modify the classification of Willan, by placing this disease in the order of pustular diseases, and by adding varus to the varieties of pustules. In the subdivision of the genus we have little alteration to propose, except that we should prefer acne *follicularis* to acne *punctata*, as explanatory of that species of the disease; and that as it is our intention to distribute the syphilitic eruptions according to their external characters, considering the form of the eruption to be determined more by peculiarity of individual constitution than essential to the nature of syphilis, we shall have occasion to subjoin another species. Were this classification perfectly natural, mentagra, or sycosis, ought to find its place in this genus; but not wishing to introduce any innovation in the arrangement which can be avoided, we shall follow Willan and Bateman in considering it apart. This genus will, therefore, consist of the following species :—

1. Acne *simplex*, 3. Acne *indurata*,
2. —— *follicularis*, 4. —— *rosacea*,
5. Acne *syphilitica*.

1. Acne simplex,—*Syn.* Ἴονθοι (*Grec.*); Vari (*Lat.*); Psydracia acne (*Sauv.*); Gutta Rosea *hereditaria* (*Darwin*); Dartre pustuleuse miliare (*Alibert*); Die Finnen (*Plenck.*)

This species consists in an eruption of small vari, appearing chiefly on the face, temples, or forehead, upon the shoulders, the upper part of the back, or breast. These pustules, which are not numerous, are generally observed to succeed each other. They go through their course separately, without any symptom of constitutional disorder, and generally without any local pain, heat, itching, or uneasiness, so that it is not uncommon to meet with people having a considerable eruption of vari upon the back, without their being aware of it. These pustules first appear under the form of small inflamed points, which are felt in the skin like small hard seeds, about the size of a pin's head; they continue to enlarge for three or four days, and about the sixth or seventh day they attain their greatest size, when they are red, smooth, elevated, and somewhat acuminated. They are hard, but seldom painful to the touch. After two or three days more, a small speck of yellow matter appears on the apices of some of the pustules; when these break, a thinner matter is secreted which soon dries into a thin yellowish scab. After the suppuration is finished, (which, in proportion to the size of the pustule, is always inconsiderable,) and the scab separated, there still remains a red point, a little elevated, which only disappears very gradually. At other times the redness and swelling continue, and if that is the case with a considerable number of the pustules, whilst new ones are appearing, the disease approaches more or less to the acne *indurata*. Or when the disease has continued some time, a general redness and roughness of the intermediate skin takes place from the coalescence of the inflamed areolas of the pustules.

Sometimes, however, instead of the pustules appearing in succession, a considerable number of them break out simultaneously, covering almost the whole surface of the forehead; a circumstance which is most frequently observed in young females. And when the pustules exist in a considerable number, the sebaceous follicles appear to suffer a certain degree of irritation, for the skin has an oily shining surface; suppuration is retarded, and the pus is smaller in quantity, and a very thin scab forms, which separates so quickly that it is sometimes not observed: or, at other times, and more especially when the eruption is seated upon the back or shoulders, the suppuration is more abundant, and the scab is thicker, but soon detached by the friction of the linen.

This eruption, very correctly delineated in Bateman's LXII. plate, and in the 23d of Thomson's Atlas, is very inadequately represented in the 22d Plate of Alibert's splendid work.

The acne simplex, which is rare before puberty, occurs chiefly in young people about that age, and is very common in young females on the first appearance of the catamenia. In some individuals this eruption continues for some time to recur, or to become more troublesome at the menstrual period, and is not an unusual attendant upon dysmenorrhœa: in others, who have it partially, it frequently returns at short intervals; but in others, who are more strongly predisposed to it, it is more extensive, and never wholly disappears, being more or less troublesome at uncertain periods. It is a disease, even when present in a very considerable degree, perfectly consistent with the enjoyment of good health; for which reason it was formerly considered a salutary effort of nature to relieve the constitution. Many people experience a decided relief in disorders of the digestive organs on the appearance of vari; so that, on many occasions, they seem to be critical. And Bateman observes that severe indigestion, or continued pains in the stomach, have been immediately relieved after an eruption of vari; in which instances there is occasionally also an eruption of lichenous papulæ on the body and limbs. It appears, however, to be most closely connected with an imperfect performance of the functions of the womb, with a constipated state of bowels, or a sluggish state of the secretion of the liver; and hence the vari have sometimes been called atrabiliary pustules. It does not, like many other cutaneous diseases, depend upon irritation or an irritable state of the mucous membranes of the alimentary canal, but more often co-exists with an atonic state of the digestive organs. But whatever may be the pathological condition of the body upon which it depends, the cause which has unquestionably the leading influence upon this complaint is hereditary predisposition. Sedentary habits, an indolent manner of living, extremes of diet, spare as well as rich, and anxiety of mind, tend to confirm this predisposition; and wherever it exists, trifling causes are sufficient to excite the disease. Amongst these may be mentioned errors of diet; excesses at table; violent exercise in hot weather, or in heated rooms, especially when followed by cold drinks; eating cold raw vegetables, as cucumbers, turnips, melons, when the body is much heated; exposure to the heat of the sun or of the fire; the application of irritating cosmetics; vexation of mind, bursts of passion, or any strong mental emotion.

It would be difficult to mistake the eruption of acne simplex, in its pure state, for any other cutaneous affection. Ecthyma is the disease which, in appearance, it most resembles; but the vari of acne may easily be distinguished from the phlyzacious pustule of that disease by their smaller size, by their slower progress, and by their base continuing indurated after suppuration: whilst the pustules of ecthyma are large and superficial, never accompanied with chronic indurations, and form thick scabs more or less prominent. When the eruption of acne *simplex* has frequently recurred in the same part, as on the nose or forehead, the skin takes on a general appearance, which, by an inexperienced observer, might be mistaken for a pustular or the small tubercular syphilitic eruption; but the particular red copper-coloured areola, and the disposition of the syphilitic tubercles to ulcerate upon their summits, will easily distinguish them; whilst the concomitant constitutional symptoms clear up all doubts which might arise.

Bateman has undoubtedly been guilty of an oversight in considering the acne simplex as a local disease, and leaving it to be treated chiefly by external applications. But in this opinion he is, indeed, almost solitary; for the united experience of the best observers is against him. Like almost every affection of the skin, when long seated in any part, it may persist as a local disease; but in its origin it is strictly symptomatic, and is invariably aggravated by any disorder of the functions of those organs in which it has its source.

When the pustules of acne *simplex* are few in number, they scarcely deserve any attention, except as symptoms of some constitutional derangement; but when they are considerable, they require the use of different medical measures, as well general as local, on their own account. When the disease appears to be connected with an unsatisfactory discharge of the uterine functions, the treatment must be directed to this object. In young persons of a strong and plethoric constitution, and particularly if about the first appearance of the catamenia, a small bloodletting will afford the most immediate relief; or, if there is pain of the back or loins, a few leeches may be applied to each groin, the feet may be immersed in a warm salt-water pediluvium, and the bowels preserved in an open state by some cooling saline aperient, as the sulphate of magnesia dissolved in infusion of roses, and acidulated with diluted sulphuric acid, or the sal polychrest in combination with very small doses of rhubarb. When the patient is more delicate, the sulphur lotum in combination with magnesia and rhubarb affords a very safe and satisfactory remedy. It is conveniently administered as follows:—℞ *Sulphur. loti, magnesiæ* āā ʒi.; *Pulv. rhei.* ℈i.; *Pulv. rad. glycyrrhiz.* ʒss. *Fiant pulveres sex, quorum unus bis terve die sumendus.* To this may be added the use of five grains of the pil. aloes cum myrrhâ at bed-time; or, if the patient is pale, and the circulation languid, small doses of the sulphas ferri may be combined with the aloetic pill. If the eruption is extensive or obstinate, five grains of the pil. submuriat. hydrargyr. comp. may be taken at bed-time, instead of the aloetic pill. The diet should be light, cooling, and easy of digestion; and wine and all heating drinks should be abstained from.

The same general treatment is applicable to young male subjects; a small venesection, cooling saline aperients, the powder of sulphur, magnesia, and rhubarb, and, if necessary, a few grains of Plummer's pill, and a course of decoction of taraxacum, with a little sulphate of potass. In both cases, after the aperient and alterative remedies, the diluted *mineral acids* are useful remedies.

The best local application to the eruption in the early stage is decoction of bran, decoction of the seeds of cucumbers or melons, or the emulsion of bitter almonds. It is not until the eruption has declined and become chronic, that gently stimulating applications are required, and they are then of much use. The effect of any irritating lotion used in the early state of the eruption, is to multiply the pustules; but after suppuration, when proportioned to the sensibility of the local affection, they are often of the greatest use. Nor in this period of the disease need there be any apprehension of producing internal disorder by the sudden repulsion of these cutaneous eruptions; it is only in the early and active state of the disease that headache and disorders of the digestive organs have sometimes been thus produced. The milder, but sometimes not the less efficacious, lotions for this purpose are sulphurous mineral waters, a weak solution of sulphuret of potass, (℞ *Potassii sulphureti* ʒi.; *Aquæ* f.Oi.) or the lotion which is made by pouring a quart of boiling water upon an ounce of sulphur, and allowing it to infuse twelve or fourteen hours. When the eruption is extensive, the same preparations may be used in general baths at 96°, (℞ *Potassii sulphureti* ℥iv.; *Aq.* c. c. *fiat balneum.*) Lotions, containing alcohol, afford very satisfactory applications to this eruption. (℞ *Aquæ rosæ* Oss.; *Alcohol.* f.℥ii.; *fiat lotio.*) The proportion of spirit must be diminished or increased according to the excitability of the skin; but it must not be forgotten, that a slight increase of inflammation is often advantageously excited by the first application of a moderate stimulus; that this transient irritation is overcome by persevering in it; and that, in this way, the skin acquires the power of bearing an increased degree of stimulus. The efficiency of alcoholic lotions is sometimes increased, by the addition of a little of the liquor ammoniæ acetatus, or acetous acid, or subcarbonate of ammonia. The muriate of ammonia, in lotion, is sometimes very useful in chronic cases of acne simplex. (℞ *Aquæ rosæ* Oss.; *Aluminis* ʒiii.; *Ammoniæ muriatis* ʒi.; *Potassii sul-*

phureti ℈i; *ft. lotio.*) When stronger irritating remedies are necessary, which is, however, seldom the case, muriate of mercury, in small quantities may be added to the alcoholic lotions. (℞ *Aquæ destillat.* Oss.; *Alcohol.* f.℥i.; *Hydrargyri chlorid. corrosiv.* gr. vi. *ft. lotio.*) It sometimes happens, that in old cases of acne *simplex*, much benefit is derived from exciting an inflammatory state of the eruption. Bateman mentions a lady who considered herself much benefited, after a severe inflammation, and even excoriation of the face, which had been produced by a poultice of bruised parsley. But it is seldom necessary, in this species of the disease, to have recourse to the remedy of Ambrose Paré, revived by Darwin, who affirms that blistering the whole face, in small portions successively, is the most effectual remedy for the inveterate forms of this acne.

The ancients, in the treatment of vari, chiefly relied upon external stimulant applications. These consisted of lotions and liniments, containing vinegar and honey, sometimes combined with an emulsion of bitter almonds, and sometimes with resin, myrrh, turpentine, and other gums, with alum, soap, and Cimolian earth; or the bruised roots of the lily, cyclamen, and narcissus. But the fruit of the wild vine (*labrusca*) is the application which Pliny (*Hist. Nat.* lib. xxiii. cap, 14,) mentions as most especially useful.

2. **Acne Follicularis**, Maggot Pimple.

Syn. Acne punctata (*Willan*); ἴονθος (*Grecorum*); Varus (*Latin*); Crinones, Crimones (*Variorum Auct.*); Grutum milium (*Teutonicè*); Der Gries (*Plenck*); Punctæ mucosæ (*Darwin*); Grubs (*Anglicè*); Tannes (*Gallicè*).

Pustules, having the precise character of vari, are observed to have their seat in the sebaceous follicles; sometimes originating locally from the accumulation and induration of sebaceous matter, causing their obstruction (*emphragma sebaceum*); and sometimes symptomatically, from inflammation of the follicles, arising from some disorder of the internal organs. When the vari are produced by the first named cause, the sebaceous matter, by being exposed to the air at the mouths of the follicles, assumes a black appearance, and the pustules present a black point on their summit, surrounded by a very slightly raised border of cuticle. This circumstance, which gives sometimes a particular feature to the disease, afforded Willan the specific character of acne *punctata*; but for which as this appearance is far from being constant, and as pustules have their seat in the follicles without presenting it, we have substituted *acne follicularis*, as better explaining the nature of the affection.

A loaded and obstructed state of the sebaceous follicles may exist to a considerable extent, without inducing inflammation; and only very minute hard white tubercles, of the colour and size of millet seeds, are to be observed, from which the sebaceous matter being pressed out through the circular orifice of the follicle, takes a filiform shape, bearing a close resemblance to a maggot. That it really owes its form to the manner in which it is forced through the aperture of the follicle is obvious; for, if the black spot is ruptured by a fine needle, it will be seen to be a mere deposition of sebaceous matter of a round form. In this state they are commonly known by the name of crinones, worms or grubs. [Recently, it has been found, that these follicles are occupied by a parasitic insect, (*Acarus folliculorum*,) which has been found alone or in clusters of several in a single follicle. In the perfectly healthy state of the follicles, they are few in number; but when sebaceous matter, which seems to serve them for aliment, is allowed to accumulate, they abound. The insect was first observed by M. Simon, of Berlin, and has been since seen and described by Mr. E. Wilson, in his work on Diseases of the Skin.] As the matter accumulates and hardens, it becomes a source of local irritation, and the sebaceous crypts, in consequence of distension, inflame and form pustules, which suppurate imperfectly. At other times these obstructed follicles remain stationary, without ever passing into the inflammatory state; or the accumulation of the matter goes on increasing until they form considerable follicular tubercles, resembling those of molluscum, and sometimes tumours of considerable size, or, occasionally inflaming, assume the appearance of indolent boils.

The disposition of the body to the accumulation of the sebaceous matter in the follicles of the skin is much dependent upon peculiarity of constitution, but is always very intimately connected with a constipated state of the bowels, so that in many individuals the necessity for aperient medicine is indicated by the sebaceous follicles appearing full or prominent.

Besides this origin of follicular vari, they may also be produced directly without any collection of sebaceous matter either by local irritation, in which way some kinds of cosmetics seem to act, or by inflammation of the follicles arising symptomatically from the irritation of the internal organs, as the bowels or the womb.

The follicular may often be seen mixed with the simple vari in this and the other species of acne. Of this complication there is a very accurate delineation in Bateman's LXII. plate.

For the removal of follicular vari, besides the general treatment of acne *simplex*, which is also applicable here, it is necessary to empty the follicles by mechanical means, either by pressing on both sides of the pustules until the hardened matter is sufficiently elevated to be taken hold of, or by employing a blunt curved forceps for this purpose. But when this state of the follicles exists, to a considerable extent, nothing so effectually empties them and clears the skin as the vapour bath, followed by the warm sulphurous bath. Lotions of sulphuret of potass, with or without alcohol, are of great service when the disease is of small extent. When the disease has subsided, and the state of the skin admits of it, general friction with the flesh-brush, a flannel glove, or a coarse towel, is of great use. The internal remedies most suitable in this complaint, are powders of sulphur, magnesia, and rhubarb, with an occasional saline aperient. Dr. Underwood recommended the use of a solution of carbonate of potass internally, and Dr. Willan was in the habit of occasionally prescribing the oxymuriatic acid; and there can be no doubt that any other medicines which improve the functions of the digestive organs and benefit the general health, have a considerable influence in correcting this unhealthy state of the skin. It is probably in this way that the following alkaline tonic, recommended by Dr. A. T. Thomson, produces its effects; (℞ *Zinci sulphat.* gr. xxiv.: *Liquoris* *potassæ* f.ʒxii.; *solve. Sumantur guttæ* xxx. *ex cyatho aquæ bis quotidie.*)

8. ACNE INDURATA, Stone-pock.

Syn. Αἰθόλικες (*Hipp.*); Vari (*Latin*); Dartre pustuleuse disseminée (*Alibert*); Pustulæ solitariæ (*Teutonicè*); Eiterfinnen (*Plenck*); Pustulæ inflammatoriæ (*Lorry*).

In this species the vari are larger, less regular in their figure, sometimes ovate as well as conoidal; they are deeper seated; the inflammation of the surrounding skin is more extensive; suppuration takes place still more slowly, and is followed by thicker scabs and by partial indurations, more or less considerable, in the subcutaneous cellular tissue as well as in the skin. It attacks the face most commonly, but is also very frequently observed upon the upper part of the back, shoulders, and breast, and has sometimes been seen to cover the whole posterior part of the trunk. It affects chiefly young adults of both sexes, but the severest cases are met with in young men. It affects most generally persons of gross phlegmatic temperament, who have a thick greasy skin: and though the strong and robust are more frequently the subjects of its attacks, it does not spare the weak or exhausted. We have certainly observed it more frequently in patients of a scrofulous habit than in others. We have known it co-existing with a strong family predisposition to mania; and it has been observed in connection with the hemorrhoidal constitution and pulmonary consumption. It is sometimes accompanied with symptoms of abdominal derangement; but it is also sometimes the only discomfort of people enjoying, in every other respect, perfect health. In persons predisposed, it is generally excited by irregularity of diet, by cold food or drink when the body is heated, and sometimes it is developed by external irritating applications, as a blister.

This complaint presents itself in very different degrees of intensity. Sometimes it is very slight; a few red inflamed points show themselves in the forehead, temples, the upper part of the cheeks, or over the angles of the lower jaw; these become pustules of a bright rose colour, which, rising slowly, only after two or three weeks, end in suppuration, or sometimes never arrive at that state. The pustules when red are sore and tender to the touch, but as they decline they become livid and less painful. These are succeeded by other pustules. After suppuration, the skin on which they are seated remains hard and of a bright rose red, and the subcutaneous cellular tissue assists in forming tubercles, or chronic indurations. In this manner, a certain number of pustules having succeeded each other, the affection gradually subsides.

But, in general, the disease is much more severe; the whole face is covered with irregular bright red pustules and livid red tubercles; they are particularly large and numerous on the rami of the lower jaw and under the jaw; on the temples and cheeks; and smaller but not less thickly spread upon the nose and forehead. These tubercles themselves often suppurate, forming superficial indolent abscesses covered with skin of a livid red colour. They seldom point or find issue for their contents spontaneously, but occasionally require to be discharged by the aid of the lancet, and then the wound heals slowly, leaving a livid indented mark, which never disappears. The intervals of the tubercles are studded with pustules in different stages of their progress, either just beginning to appear, in a state of suppuration, or covered with a scab, with red spots distributed amongst them, so as sometimes to give a general red appearance to the whole surface of the skin. Occasionally a number of black points, marking infarcted mucous follicles, or true follicular vari, are to be observed, here and there, in the intervals between the tubercles and pustules, but chiefly upon the sides of the nose, cheeks, and forehead. The skin is greasy and shining, and the whole face much swollen and inflated, giving the patient a most disagreeable aspect, which is very accurately represented in Bateman's LXIII. plate.

The pustules of acne *indurata* often leave traces which it is impossible to efface, the skin being marked with many very small scars, the effects of former eruptions of this complaint, more or less frequently repeated.

Though this species of acne attacks frequently both the face and back at the same time, it sometimes spares either one or the other, but in either case the disease is of long duration and tedious; and whether it terminates spontaneously or by the power of art, the process is only completed very slowly, and patients remain very liable to a relapse.

Notwithstanding the severity of the eruption, the patient may enjoy good general health, and attend to all his wonted avocations, unless he may have to complain occasionally of headach, or a disagreeable sense of heat in the face; and it has been observed, that if a fever, or other severe disease, should take place, the eruption often subsides or disappears; so that its recurrence under such circumstances is to be deemed a sign of returning health. Bateman has seen the erethism of a mercurial course, administered for other purposes, occasion the disappearance of this acne, which returned with the restoration of flesh and strength, after the omission of the medicine. And we have observed that in those cases in which the disease is compatible with otherwise good health, it is also invariably the most difficult to cure.

When acne *indurata* is severe or of long duration, it is a disease most difficult to subdue, and often resists the most skilful and the most persevering treatment. If the eruption is sudden or extensive, and appears in a subject of sufficient strength, nothing makes so decided an impression upon it as venesection; and, even in delicate subjects, advantage may be derived from the detraction of a few ounces of blood. In the inflammatory state of the disease, cooling saline purgatives, with a mild alterative mercurial pill at bed-time, and the antiphlogistic regimen form the essential parts of the constitutional treatment. As the disease declines, or becomes chronic, the mineral acids are often used with great advantage; and the internal use of the sulphureous mineral waters, as those of Harrogate, are amongst the most successful remedies. Dr. Bateman thinks that advantage has been derived from the internal use of small doses of soda, sulphur, and antimony, assisted by proper external treatment. Neither purgatives nor the antiphlogistic regimen should be continued longer than the first active state of the disease. On the contrary, it is frequently of advantage to have recourse to mild tonics and alkalis; and, on the same occasions, the greatest benefit has been derived from changing from a poor to a more generous diet. Lorry relates the case of a water-drinking monk, whom he relieved of this complaint by the moderate use of wine. The constitutional disease with which this complaint appears to be most connected is atonic dyspepsia, with a constipated state of bowels; it is, therefore, obvious that a plain moderate diet of animal food is more likely to agree than raw vegetables, cresses, and vegetable acids, used under the notion of correcting the scorbutic state of the humours.

[*In some* obstinate cases of the different forms of acne, great benefit has resulted, as in other chronic cutaneous cachexies, from a thorough change of diet, and especially from putting the patient on the use of saccharine matter between the meals, so as to modify the condition of the chyle, and through it that of the blood and of the tissues. An ounce and a half of simple syrup may be given with this view about three hours after each meal. With the syrup may be associated the iodide or iodurett*ed* iodide of potassium, in the form of the *liquor iodini compositus* (*gtt.* x—xx ter *die*). *By* a perseverance in this course for *eight or ten* weeks, some very obstinate cases have *yielded*, See *Dunglison's Practice of Medicine, 2d. edit., p.* 129. Philad. 1844; and his *Elements of Therapeutics and Materia Medica, Vol. 2, p.* 315. Philad. 1843.]

But constitutional treatment would be of little avail without the assistance of local means for accelerating the progress of the pustules, or for promoting the resolution of the tubercles. In the early stage of the eruption, mild emollient applications are most suitable, such as demulcent decoctions or poultices, which, if there is pain, may be made with the decoction of poppy heads. When the pustules have suppurated, and are slow in discharging themselves, it is advisable to apply to them, as Turner recommends, the common principles of surgical treatment. After the pustules have discharged their contents, either spontaneously, or by means of the lancet, stimulating alcoholic lotions, containing a small quantity of corrosive sublimate, are chiefly to be relied on, such as have been mentioned for the severer cases of acne *simplex*. In the hospital of St. Louis, at Paris, the greatest advantage has been derived from rubbing the pustules, as well as the tubercles, with the following ointment: R. *Hydrargyri ammoniat.* ℈i. ad ʒi.; *Adipis*, ℥i. But of all the preparations for promoting the resolution of the tubercles of acne *indurata*, none are, according to M. Biett, to be compared to the *iodide of sulphur*, mixed with lard. (R. *Sulphur. iodid.* gr. xii. ad gr. xxiv.; *Adipis*, ℥i.) *M. Biett* employs this remedy in the wards of the Hospital of St. Louis with decided benefit. In some severe cases of acne *indurata* submitted to the friction of ioduret of sulphur, the tubercles were resolved with astonishing rapidity. But the good effects of all these means are very much promoted by the use of the vapour bath, and more especially of the *douche of vapour*, directed for twelve or fifteen minutes upon the eruption.

It is principally in old chronic cases of the acne *indurata*, where the local affection has completely established itself, that it may sometimes be necessary to have recourse to means for changing entirely the action of the part; and for this purpose, blisters, used by Ambrose Paré, under the notion of drawing out the peccant humours, and revived by Darwin, have been frequently used in the Hospital of St. Louis, and have been found eminently useful. [Solid nitrate of silver has been rubbed over the parts, and they have been brushed over with one of the concentrated mineral acids with a similar object.]

During any recurrence of a considerable fresh eruption, the means adapted to the chronic state of the disease must necessarily be suspended, and recourse had to the constitutional and local means suited to its inflammatory state.

M. Biett has found that when the disease has disappeared, a lotion, or douche of cold sulphurous water is of great use in establishing the cure, and in preventing a return of the eruption.

4. ACNE ROSACEA, carbuncled face.

Syn. Ξένιον (*Grec.*); Varus (*Roman*); Gutta rosea et rubedo (*Auctorum*); Gutta rosacea œnopotarum et hydropotarum (*Teutonicè*): Kupferbandel (*Plenck*); Bacchia (*Linn.*); Gutta rosea *hepatica* (*Darwin*); Herpes pustulosus gutta rosea, Dartre pustuleuse couperose (*Alibert*); Ionthus corymbifer (*Good*); Saphirs, Goutte rose, couperose (*French*); Roth-gesicht, Roth-nase (*German*); Red pimpled face.

In a correct pathological nomenclature, as the last species might with greater propriety be termed acne *furunculus*, being a complication of the varus with phlegmon, or inflammation of the subcutaneous cellular tissue, so this species would be more accurately distinguished under the name of acne *erythema*, the pustules of acne being combined with an erythematic inflammation of the skin. In this respect, as regards the local or external disease, acne *rosacea* differs from the other species, the vari sometimes preceding and developing the erythema, and the erythema, on the contrary, being sometimes the occasion of the vari. From this circumstance has arisen the distinction of gutta rosea, observed by Nicolaus Florentinus, Ambrose Paré, Astruc, and Plenck, dividing it into species, under the terms of *simplex*, or pure erythema,—*pustulosa* and *bacchialis*, the acne *rosacea* of Willan,—and *squamosa ulcerans* and *varicosa*, the sequelæ of obstinate forms of that disease.

The nose is, commonly, the first seat of this affection. In persons predisposed, who are generally of the middle age, after any exciting cause, as a full meal, heating drinks, or indigestible substances, the extremity of the nose becomes of a deep red colour, more or less intense, which at first gradually subsides with the removal of the exciting cause; but, at length, by repetition, grows to be habitual. In this red shining appearance of the nose, some elevated points of a brighter red colour, sometimes distinct, sometimes in groups, are afterwards observed. These points enlarge, becoming pustules, which suppurate at their summits; but the suppurative process is always imperfectly established, forming seldom more than a small white acuminated point on the apex of the pustule, which makes a striking contrast with the dark damask red colour of the pustule, an appearance which is well represented in Alibert's XXI. plate. This white point of the pustule bursts and forms a thin white scab, which, detaching itself, leaves beneath it a hard phymatous tubercle. These pustules succeed each other, and in this manner the disease perpetuates itself.

Sometimes the disease is confined exclusively to the nose, which, from the repetition of this morbid process, and the successive formation of tubercles, increases very considerably in size, being covered with knobs and asperities, whilst the blood-vessels of the surface of the skin are seen enlarged, and the small veins appearing varicosed, have the appearance of bluish lines, strongly contrasted with the general red colour of the surface; or the intermediate skin is striated with reticulations of enlarged cutaneous veins, resembling an injected membrane, an appearance which is correctly delineated in Bateman's LXIV. plate. M. Alibert thinks he has observed, that the right side of the nose is more liable to be affected with this species of acne than the left, a circumstance which he connects with the influence of the state of the liver upon this disease. More generally the size of the nose is not increased, but its form only altered; and the disease extends itself to the cheeks, forehead, and chin, so as sometimes to cover the whole face. The red colour of the skin, which is always more remarkable after dinner, or in the evening, than in the morning, is not anywhere equal in degree, but is always more so in the seat of the pustules. The disease may cease and return in different degrees of intensity; but after it has continued for some time, the surface of the skin becomes uneven and rough, and if the disease should even disappear, the skin never entirely recovers its natural state.

In general this eruption produces little discomfort of feeling in proportion to its deformity, seldom more than a slight momentary itching; but some persons have the face in a very irritable state, with the sensation of heat and burning, being frequently obliged to bathe the face in cold or tepid water for relief. After eating, drinking, or any moderate exercise, they feel a sudden glow of heat in the face; but it is chiefly when they approach the fire that they suffer most; it produces in them a sensation of pungent heat, or of burning and itching.

Hereditary disposition is, unfortunately, one of the most common predisposing causes of this disease, and one which sometimes inveterately adheres to many successive generations. Alibert traced the disease, in one family, through four generations. This predisposition frequently shows an affinity with that of scrofula, but is always intimately connected with the state of the functions of the abdominal viscera, and hence causes tending to establish an unhealthy state of these is liable to induce this predisposition. For this reason, the indulgences of the table, in eating as well as in drinking, violent emotions, or long and intense exertions of the mind, sedentary occupations, and much watching, are amongst the most frequent causes of it. Persons of middle age are consequently most liable to it; and it is most frequent in men of a hemorrhoidal constitution, and in women at the critical period of life, or in such as suffer from disorder of the uterine functions. Notwithstanding the difference of habits, it seems equally common to both sexes. Sometimes it shows itself, or is increased, during gestation; but in other circumstances, it has been observed to disappear during pregnancy, and return after parturition. Besides these causes, anything which favours or determines the afflux of blood to the head, increases the tendency to this complaint. It will, therefore, be easy to understand, from the causes just assigned, why it should be met with amongst men of letters, lawyers, merchants, and gamesters, and in public offices; among women employed in drawing, painting, and tambouring; and in those whose avocations oblige them to keep the head in a depending position. It is not, however, to be forgotten, that the acne *rosacea* sometimes appears in people of the most sober and temperate habits, and that it sometimes shows itself in conjunction with a state of exhaustion and general debility.

In people predisposed to this complaint, either hereditarily or by habits of life, it may be immediately excited by local irritation, as by long exposure to a hot sun, to the heat of the fire, or the application of strong cosmetics. Violent exercise, bursts of passion, or fits of chagrin, are also capable of developing it. Alibert mentions the case of a lady, who, having been entirely cured of the complaint during a methodical treatment of it at the establishment at Tivoli, on receiving some afflicting news, in the course of twelve hours relapsed into a state worse than ever. But it most generally makes its appearance after errors of diet, of which, when the predisposition is strong, any moderate degree is sufficient to produce it. These exciting causes explain why it is so generally met with amongst cooks, glassblowers, mowers, couriers, and players.

This complaint is, frequently, a symptom precursive of diseases of the liver, but sometimes they coexist contemporaneously. It seems generally to depend more upon a state of abdominal plethora, or congestion of the liver, than upon any irritation or irritable state of the mucous surfaces of the alimentary canal; and hence spongy bleeding gums, and habitually torpid and confined bowels, are its usual attendants.

The treatment of acne *rosacea* demands great perseverance, and even in spite of this, it is frequently unsuccessful. To every form and variety of this complaint, with few exceptions, one part of the treatment is generally applicable and essential, and it is that which consists in a strict adherence to proper diet and regimen, adapting them as much as possible to the correction of that state of body which constitutes the predisposition, and avoiding all those causes which have the power of exciting it. These views will be attained by leading a sober temperate life, by using a mild diet of easy digestion, by avoiding excesses at table, by abstaining from spirits, liquors, and sometimes even wine; by avoiding hot fires, heated apartments, and violent exercises, and by endeavouring to eschew violent emotions of mind or close applications of the understanding. The power of this plan will be increased, and the general object promoted by the use of appropriate remedies, suitably adapted to the peculiarities of the case. If much local inflammation be present with general plethora, a moderate venesection may render great service. If the eruption is connected with the suppression of any accustomed evacuation, the propriety of endeavouring to restore it naturally suggests itself; if the menstrual function is laborious, imperfect, or irregular, the proper modification of the method of cure readily occurs; if a congestive state of the liver is present, or when the liver is more severely affected, mild alterative remedies—as Plummer's pill;

taraxacum, and sulphurous mineral waters, as those of Harrogate, are applicable. These last are of known efficacy, and are much to be preferred to the saline mineral waters. In all cases an open state of the bowels is of importance, but much purging is generally detrimental. We have great doubt whether any constitutional remedy has a specific action upon the local disease. In France and Germany the dulcamara and viola tricolor have been much used; but we think that, united with the general treatment, more benefit is derived from the use of the liquor potassæ taken a few hours after each meal.

A judiciously directed topical treatment is of great importance in the cure of this disease. In sudden and acute attacks a few leeches may be advantageously applied near the seat of the complaint, especially when this eruption affects females at the critical period of life, although, in these cases, small general blood-lettings are sometimes of greater service. In the same state, mild, tepid, demulcent applications are to be frequently used: amongst these the decoction of beans has always enjoyed a great reputation: and as the inflammatory affection subsides, sulphuretted lotions form the most useful applications. If the disease is not benefited by these means, more stimulating lotions may be had recourse to, but in general they are less useful in this species of acne, and require more circumspection, for they not unfrequently aggravate the complaint. Gentle astringent lotions of alum, combined with a very small quantity of alcohol, are sometimes very useful, and in an indolent state of the local disease, the vapour-douche directed to the part affected, has been often found of great service; the same state also sometimes admits of moderate friction, or resolving applications. It is to these cases that the remedy of Ambrose Paré, a blister applied to the diseased part, deserves consideration, a practice the utility of which has been occasionally verified in the Hospital of St. Louis. Nor are the general principles of surgical treatment to be neglected here; for when the vari are seated in the follicles, the focus of irritation is removed by evacuating them.

Besides these general and local means of treatment, the nitro-muriatic foot-bath, in the proportion of two ounces of the acid to twelve pints of water, has been very much recommended; and in many diseases of the skin we have found the greatest benefit from sponging the sound parts of the skin, two or three times every morning, with a lotion consisting of two drachms of nitro-muriatic acid, and two pints of water. It is also frequently of advantage to apply a blister to the arm, or to open an issue as a derivative.

5. Acne syphilitica.

Syn. Gutta rosacea syphilitica (*Plenck*); Syphilide pustuleuse miliare (*Alibert*); Pustules syphilitiques psydracées (*Rayer*.)

The multifarious forms of cutaneous diseases which have been described as originating in syphilis, may fairly be said to have deprived that disease of any specific character, for there is scarcely a morbid appearance presented by the skin which may not, in a modified state, be found amongst syphilitic eruptions. But if any one will take the pains to examine into this matter, he will find, what might reasonably have been expected as being more in accordance with the general laws of pathological phenomena, that though there are certain forms of cutaneous disease essential and peculiar to syphilis, the greater number of those described as syphilitic, depend upon the constitutional predisposition of the individual, modified by the syphilitic virus; and that whilst the influence of this disease impresses upon them a general character, their particular form depends upon the pathological peculiarity of the individual. Thus, if lichen, lepra, or any other cutaneous disease, makes its appearance in persons tainted with the venereal poison, these diseases, though originating in ordinary causes, will suffer a relative modification. In proof of this, we find that the syphilitic acknowledges the same causes as the other eruptions, being excited by errors of diet, violent exercise, strong mental emotions, &c. It seems, therefore, more natural in a classification founded on external characters, to distribute the syphilitic eruptions in each genera as their external appearance would require them to be arranged, rather than to confound them together under a class of anomalous eruptions. In this way the general treatment required for this disease may be modified by the peculiar character of each eruption, and the student will be led more naturally to find the place of the eruption in the classification. This is evidently the view which Plenck took of these diseases, and the plan which Willan intended to pursue; but M. Alibert, as faulty in method as correct in description, has formed the venereal eruptions into a class under the name of *syphilides*, and M. Biett, to whom we are so much indebted for a more correct knowledge of many of these diseases, has omitted to correct this error of classification. They who are conversant with diseases of the skin, will find some difficulty in following Mr. Carmichael in arranging these eruptions under his papular, pustular, phagedenic, and scaly diseases, and will be disposed to doubt whether, under these descriptions, he has been so successful as to include such as are peculiar to, or characteristic of, the venereal disease.

Under the term gutta *rosacea syphilitica*, Plenck had marked the acne syphilitica. It corresponds nearly to the disease described by Alibert, under the term syphilide *pustuleuse miliare*, and, by Biett and Rayer, pustules *syphilitiques psydracées*. It is the least common of the syphilitic pustular eruptions, and affects chiefly the face, forehead, neck, and trunk. The pustules of this eruption correspond very neary in form and dimensions to those of acne *rosacea*; they are round, conical, and acuminated, surrounded with an inflamed areola, and possess the true character of vari, suppurating only at their apex, and invariably terminating in tubercles. They are, however, distinguished from them by their deep, red, amaranthine, or copper-coloured areola, by their brownish yellow scab, and by their leaving a small, slightly depressed cicatrix. A correct delineation of acne *syphilitica* is still a *desideratum* in this branch of medicine; but, in general, the nose, cheeks, and forehead present a livid copper colour, as if stained with the lees of wine. In these discoloured patches, pustules appear from time to time, which leave behind them small dark red tubercles, chiefly on the forehead, nose, or adjacent parts of the cheeks. As the pustules succeed each other, they are to be seen mixed together in every stage of their process. With the acne *syphilitica* may sometimes co-exist eruptions of another character (frequently scaly) upon the extremities.

The acne syphilitica is always a secondary syphilitic affection, consequent to chancre; it is not uncommon to see it totally unaccompanied with any of the other secondary symptoms of that disease, but its most usual attendants are nodes, inflammation of the periosteum, and nocturnal pains.

The specific treatment of acne syphilitica, which must still be that on which every prudent practitioner will chiefly rely, demands modifications adapted to the general nature of acne. In the early state of the eruption it is better to pursue the means found useful in the ordinary forms of that disease, and to reserve the mercurial treatment for the chronic stage. By this method a much smaller quantity of mercury suffices for the cure. The action of the mercury is rendered much more efficacious when combined with a course of taraxacum or sarsaparilla. In a case of this disease, which came under our care lately, the greatest improvement was effected in the eruption by the use of sarsaparilla alone, given in powder; in general it is more efficient when combined with mercury, and we are acquainted with no preparation which fulfils this intention better than the celebrated decoction or tisan of Feltz. (R. *Aquæ* Oxii: *Antimonii sulphuret.* ℥iv: *Rad. sarsaparillæ* ℥ii: *Hydrargyr. chlorid. corrosiv.* gr. iij. *Ichthyocollæ* ℥iss. *The antimony to be enclosed in a muslin bag, and the whole to be boiled gently until the water is reduced one half, except the corrosive sublimate, which is to be added after the decoction has been strained,*—Oiss is the proper daily dose.)

As a local application the fumigation of cinnabar is the most efficacious, lotions being of little avail. From one to three drachms of the red sulphuret of mercury may be sublimed and directed upon the part by a suitable apparatus. Where indurations remain after the specific treatment, an ointment formed of the ioduret of mercury (R. *Hydrargyri iodid. rubr.* gr. xi. *Adipis* ℥i.) rubbed upon the part, is a remedy of great efficacy, and is much assisted by the occasional use of a douche of vapour continued for twelve or fifteen minutes.

T. J. TODD.

[ACRODYNIA. *Erythema acrodynia, E. acrodynum;* from ακρος, extremity, and οδυνη, pain. A name given to an epidemic neurosis, which prevailed at Paris, and the neighbourhood, during the years 1828 and 1829, and in which the most constant and remarkable symptoms were numbness, formication, and, at times, darting pains in the hands and feet. The pain was compared by the patients to that which would be occasioned by needles or pins run into the parts. It was augmented by pressure; was intense for a time; then diminished, and after a time disappeared, leaving the skin devoid of its natural feeling, and red—the cuticle separating in large flakes. Occasionally, the mucous membranes of the intestinal canal sympathized, as indicated by diarrhœa, vomiting, gastrodynia, &c. The only constant symptom, however, was the pain in the hands and feet.

The disease was a precursor of the cholera, and not less inexplicable in its character and causation. Some died of it. It spread chiefly amongst the poorer classes, and where numbers of persons were crowded together. In the Caserne des Oursines, in Paris, it attacked 560 of 700 inmates; and in that of La Courtille, in four days, 200 out of 500. No one died of it.

Various remedial agents were employed; but they appeared to be of little efficacy. The phenomena were met by what appeared to be the most proper agents; and in the latter periods of the epidemic, the therapeutist confined himself to the use of the warm bath, fomentations, frictions, and emollient and narcotic cataplasms. (Dance, in Art. *Acrodynie, in Diction. de Médecine*, i. 515, Paris, 1832.)

About the same period, the Dengue (q. v.) appeared in the Southern part of this country and the West Indies. It seems to have been a congenerous affection. The same may be said of the affections which have occasionally been described under the name *Kriebelkrankheiten* by the Germans.

The writer had recently under his care a case of sporadic Erythema acrodynum, which yielded to pencilling the hands and feet with the tincture of iodine, after a variety of remedies had been used in vain.

ROBLEY DUNGLISON.]

ACUPUNCTURE. The passing a needle into the body is termed *acupuncture.* From forgetting that the word puncture has two significations,—that it is used to signify both the wound and the act of making it, some have termed the operation *acupuncturation.* But to subjoin the syllables *ation* to the word puncture or acupuncture, is as improper as to subjoin them to the words preparation or fabrication, each of which already ends in *ation* and has a similar twofold meaning. An exactly parallel error would be to say *manufacturation.*

The most obvious purpose of this operation is to allow the escape of the fluid of œdema or anasarca through the skin, or of the blood when superficially accumulated; but, from an idea that various disorders arose from a kind of subtle and acrid vapour pent up, it was had recourse to, for the purpose of giving this vent, by the Chinese, from time immemorial. From China the practice spread to Corea and Japan, where it has for ages been very common.

Ten Rhyne, (Dissert. de Arthritide, de Acupunctura, &c., London, 1693,) a medical officer in the East India Company's service in 1679, gave the first information to Europe of a practice unknown to the Greeks, Romans, or Arabians; and states that a guard of the Emperor of Japan, appointed to conduct the English to the palace, was seized with violent pain of the abdomen and vomiting, after drinking a quantity of iced water when heated. He took wine and ginger in vain; and then, persuaded that he had wind, had recourse to acupuncture in the presence of Ten Rhyne. It appears that the Japanese are liable to a violent kind of colic called *senki*, which they regard as too severe to arise from morbid matter in the cavity of the intestines, and ascribe to something morbid in the parietes of the abdomen, the omentum, mesentery, and substance of the intestines, converted by its stay in these parts into a vapour, the escape of which from its narrow prison, by means of acupuncture, is immediately followed by a cessation of the pain and distension. The guard laid himself upon his back, placed the point of a needle upon his abdomen, struck its head with a hammer once or twice to make it pass through the skin, rotated it between his fore-finger and thumb till it entered to the depth of an inch, and then after thirty respirations, as it would appear, withdrew it, and pressed the punctures with his fingers to force out the imaginary vapour. He made four such punctures and was instantly relieved and got well.

The needles are always made of the purest gold or silver, preferably of gold, and well tempered. Their manufacture is a distinct occupation, understood by few, and those few are licensed by the emperor. Some are fine, about four inches in length, with a spiral handle for the purpose of more easily rotating them: and are kept, by means of a ring or a piece of silk thread, in grooves, each capable of holding one, at either side of a hammer, usually made of the polished horn of the wild ox, ivory, ebony or some other hard wood, rather longer than the needle, and having a roundish head covered, on the side which strikes, with a piece of leather and rendered heavier by a little lead within. Others are of silver only, still finer at their point, but with a short thick handle bent down upon itself; and are kept, several together, in a varnished wooden box lined with cloth: these are not struck with a hammer; but a fine copper canula, about an inch shorter than the needle, is sometimes employed to steady it, and prevent it from entering too far. The selection of the part fit for the operation, or for the application of the moxa,—the other great remedy of the Japanese, is usually confided to particular persons called *Tensasi*,—touchers or searchers of the parts, while those who apply the needles are styled *Farittate*,—needle-prickers, though occasionally the common people trust to their own experience, taking care only to prick no nerve, tendon, nor considerable blood-vessel. The seat of the cause of the symptoms is the proper part, and delineations of the body are sold conveying this information.

If the patient does not bear the needle well, it is at once withdrawn: but if he does, and the disease proves obstinate, it is introduced two, three, four, five, or six times. The more severe the affection, and the stouter the patient, the deeper must be the puncture.

Kæmpfer,* a physician who accompanied a Dutch embassy to Japan, in 1691, and again in 1692, informs us that the Japanese make nine punctures, three rows of three each, at about half an inch from each other, over the liver, in cases of colic, and that he himself frequently witnessed the instantaneous cessation of the pain, as if by enchantment.

The orientals do not, however, employ this operation in affections of the abdomen only. In tetanus, convulsions of all kinds, apoplexy, gout, rheumatism, swelled testicle and gonorrhœa, and in fevers both intermittent and continued, it is also celebrated among them; enjoying credit, like all remedies of undoubted efficacy in certain diseases, for power which it does not possess over others.

Between the frightfulness of running needles into the flesh and the high improbability of any benefit derived from such a practice, a hundred and seventeen years elapsed before any European practitioner made trial of it. Dujardin in his Histoire de la Chirurgie, and Vicq-d'Azyr in the Encyclopédie Méthodique, mentioned it above a century after Ten Rhyne had published, but only to congratulate the world that the statements of Ten Rhyne and Kæmpfer had not induced any one to practise it, and the first European trials were made by Dr. Berlioz† of Paris in 1810. Its power proved so extraordinary that he employed it very extensively, and numerous French practitioners imitated his example with the same results. A body of similar English testimony followed, and acupuncture affords a striking instance of a good remedy discovered from groundless hypothesis, and condemned without a single trial for above a century.

The diseases in which the power of acupuncture is well established are pain and spasm not dependent upon inflammation or organic disease. In rheumatism of the nerves, rheumatic neuralgia,—as distinguished from that chronic form which is generally limited to a small extent of nerve, lasts a great length of time, and is independent of cold,—the invariable causes of rheumatism; in rheumatism of the fleshy parts; in simple pain of any spot; and in spasmodic and convulsive pain of various parts, whether local or migratory, its utility is very great, provided inflammation be not the cause. Of 129 rheumatic cases treated by Dr. Jules Cloquet, about 85 yielded to acupuncture. Of 34 published by others, 28 were cured. The writer of this article employed it in St. Thomas's Hospital, and published his results in the 14th vol. of the Med. Chir. Trans. Of 42 cases, taken in succession as they stood in the hospital-books, 30 were found to have been cured: and the remaining 12 had clearly not been adapted for the remedy, as either heat of the affected parts had existed or heat had aggravated the pain. Experience has fully confirmed the fact, that, if rheumatism be at all inflammatory,—be accompanied by heat, or aggravated by a high degree of heat, even though a moderate degree do not aggravate the pain, no relief is in general to be expected from acupuncture. The omission of this distinction and of a little trouble to make it with nicety, will be the chief cause of the operation proving unsuccessful in rheumatism.

In some cases of inflammation and organic disease, however, when pain has been felt apparently disproportionate to those affections, acupuncture is said to have afforded relief.

The pain both of rheumatism and of some nervous affections has occasionally shifted its seat on the application of the needles, and yielded to their repetition in its new situation. Sometimes it required longer chasing from part to part before it vanished.

The cures of ophthalmia, blindness, asthma, diplopia, and hooping cough, by this remedy, must be regarded as lucky occurrences.

The needles employed in Europe are of steel; long and fine; and furnished with either a knob of sealing-wax at their head, or, what is more convenient, a little handle of ivory or wood, screwing into a sheath for the needle. [They are usually from two to four inches long, the length being adapted to the depth it may be desired to make them penetrate. If steel needles be selected, they should be heated to redness and allowed to cool slowly, in order that they may be less brittle. At the blunt extremity of the needle a head of lead or sealing-wax is attached to prevent it from being forced entirely into the body. This is the simplest method of acupuncture, and it is as effectual as any other. If a needle-holder, or *porte-aiguille*, be used, that recommended by Professor F. Bache is as good as any that has been invented. The needle with its *porte-aiguille* consists of a handle, with a steel socket, to receive the end of the needle, which may be fixed securely after having been inserted by the pressure of a small lateral screw. By this contrivance the operator can at pleasure fix in the handle a needle of the length he may desire, and, after inserting it, he is enabled to detach the handle by releasing the screw. After all, however, needles prepared in the simple manner mentioned above are adequate to every useful purpose.] They are best introduced by a slight pressure, and a semi-rotatory motion, between the thumb and fore-finger; and withdrawn with the same motion. The pain is next to nothing, and often absolutely nothing.

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* *Engelbertus Kæmpfer*, M. D History of Japan, translated from the High Dutch by Dr. Scheuchzer. London, 1727.

† *Berlioz*, Mémoires sur les Maladies Chroniques, les Evacuations sanguines, et l'Acupuncture. Paris, 1816.

The operation may be performed in muscular, aponeurotic, and tendinous regions; and the needle introduced to the depth of from ½ of an inch to 2 inches, according to the thickness of the muscles. We should not advise it to be passed into viscera, articulations, or blood-vessels. In general no fluid escapes when the needle is removed; but now and then a small drop of blood follows; and once when the needle had been introduced into the pectoral muscle, I knew blood to spirt forth, but it was immediately restrained by gentle pressure,— an occurrence in every respect similar to what once happened in the practice of M. Bretonneau.[*]

The period during which the needle remains in the part is a matter of great importance. The pain may indeed cease instantaneously: but more frequently does not till the needle has remained some time: and my own experience accords with that of others,— that one needle, remaining an hour or more, is far more efficacious than several speedily withdrawn. I usually allow them to remain one or two hours; and have known them remain twenty-four hours, without any ill effect. I have usually found the operation requisite a second time, and in one case, lumbago did not yield till the ninth repetition.

The modus operandi of acupuncture is unknown. It is neither fear nor confidence; since those who care nothing about being acupunctured, and those who laugh at their medical attendant for proposing such a remedy, derive the same benefit, if their case is suitable, as those who are alarmed and those who submit to it with faith. Neither is it counter-irritation; since the same benefit is experienced when not the least pain is occasioned, as when pain is felt. Galvanism, likewise, fails to explain it; because, although the needle frequently becomes oxidated and affords galvanic phenomena while in the body, these phenomena bear no proportion to the benefit, equally take place when acupuncture is practised upon a healthy person, and do not take place when needles of gold or silver are employed, which, however, are equally efficacious with a needle of steel.

[We can scarcely conceive the effects to be anything more than a new nervous impression produced by the needle in the parts which it penetrates.]

Acupuncture has been successfully employed to remove the fluid of œdema and anasarca. In these cases, the needle does not require to be passed deeply; its point has merely to go through the cutis. As soon as this is done and the needle withdrawn, a small bead of water appears at the puncture, which augments till the fluid runs down; and the oozing will continue for a longer or a shorter time,— generally for some hours, occasionally for a few days, and even after death, should that event take place. Any number of punctures may be made. Although the puncture is so minute, it is, in such cases, not devoid of danger, any more than scarification, if practised below the knee. The writer has frequently had recourse to it with great advantage in œdema of the scrotum and penis, frequently along the trunk, and the whole length of the superior extremity, and on the posterior part of the thigh, and never saw or heard of the least inconvenience. But several cases have been related to him, in which sloughing, and in some of which fatal sloughing, resulted from its performance below the knee, even though the needle had been passed merely through the cutis. Before these cases came to his knowledge, he had acupunctured the leg, and even the foot, in dropsy, and never but once saw any inconvenience, and that was merely a suppuration at each puncture. It should evidently, however, never be performed below the knee except when absolutely necessary, a circumstance that hardly can happen, except in œdema not extending higher than the knee: and when we reflect that acupuncture removes an effect only, leaving the cause of the effusion untouched, and that a large number of effusions are the result of an inflammatory state, or of sanguineous congestion, and that, while lessening or removing these by bleeding, general or local, or purging, we are employing means which have also a direct tendency to excite absorption; and when we reflect upon the powers of diuretics when those measures have previously been properly employed, we shall perceive that the cases of dropsical effusion in which acupuncture is required, are comparatively few.

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[*] M. Bretonneau says, that he had passed needles into the cerebrum, cerebellum, heart, lungs, and stomach, of sucking puppies, through and through, and in all directions, with no sign of pain nor particular ill effect; unless when too large a needle was thrust into the heart, and in one instance of this, a little extravasation took place into the pericardium. So far from fearing to acupuncture the heart, Dr. Carraco would have us do so in the worst cases of asphyxia. He declares that, in the presence of several persons, he kept several kittens under cold water till they were apparently dead,—stiff, motionless, frothing at the mouth, without pulsation of the heart,— and regularly sunk to the bottom every time they were thrown into the water again; that he passed a needle into the heart; that soon the needle began to be gently agitated, then rapidly so, and one voluntary motion after another gradually recommenced, till life was fully re-established; and that the animals did as well afterwards as if nothing had happened.

Death, however, by acupuncture of the brain or spinal marrow, as a secret mode of infanticide, is notorious in works on State-Medicine. "Guy Patin relates that a midwife was executed at Paris who had murdered several infants, at the moment their head presented at the os uteri, by passing a long and very fine needle into the brain through the temples, the fontanelle, or the nape of the neck, or into the heart and its large vessels. Alberti and Brendel quote similar examples. In the *Causes Célèbres* we read the horrible story of a woman who, towards the middle of the last century, made it her business to murder all the new-born infants that fell into her hands by *acupuncture*, practised at the beginning of the vertebral column, or in the brain, *with the sole intention*, she told the judges, *of peopling heaven more and more.*"— *Fodéré, Traité de Médecine Légale*, t. iv. p. 482. sq.

[Dr. Dunglison has used acupuncture with advantage to drain off the fluid from the cellular membrane in anasarca. In such cases, larger needles are advisable. Some prefer them to be of the size of an ordinary glover's needle, and of a triangular shape,—a puncture of this kind being less likely to close. It has likewise been advised in ascites, in hydrocele, and in every form of encysted dropsy. By M. Velpeau it has been proposed to treat aneurism by acupuncture. In performing some experiments on animals, he found that arteries, punctured by the needle, became the seat of a coagulum, and were ultimately obliterated. In 1830, he read a paper before the Académie Royale des Sciences of Paris, proposing the operation in the cases in question, (*Lond. Med. Gaz.*, and *Amer. Journal of the Medical Sciences*, Aug. 1831, p. 510). He found, in his experiments, that whenever the needle remained three days in the flesh, the transfixed artery was completely obliterated.

M. Bonnet treated eleven cases of varicose veins by introducing pins through their cavities, and allowing them to remain there some time. Nine of these cases were cured. The same treatment was applied to hernial sacs. He passed three or four pins through the hernial envelopes close to the inguinal ring, and, in order that they might exert a certain degree of compression, as well as irritation, on the sac, he twisted the points and heads upwards, so as to give them a circular direction. The inflammation usually commenced on the third or fourth day, and the pins were removed a few days afterwards. M. Bonnet treated four cases of inguinal hernia in this manner. In two, the hernia was small, and three weeks sufficed for the cure: the third was more troublesome. (*Bullet. Général de Thérap.*, and *Amer. Med. Intelligencer*, *Dec.* 1, 1837, p. 317; and *Archiv. Général. de Médecine*, *Mai*, 1839.)

Acupuncture has likewise been employed to remove a ganglion of considerable size on the extensor tendons of the foot. After the needle was inserted, pressure was applied, and within a week the tumour had entirely disappeared. (Mr. Vowell, *Lond. Lancet*, *Aug.* 25, 1838, p. 770.) When acupuncturation is conjoined with galvanism or electricity, it constitutes *galvano-puncture* and *electro-puncture* (q. v.). See, on the whole subject of acupuncture, Dunglison's *New Remedies*, 4th edit., p. 53. Philad. 1843.]

JOHN ELLIOTSON.

AFFUSION. See articles BATHING and FEVER.

AGE. In nothing are organized beings more remarkable than in that perpetual mutation which seems to constitute the fundamental law of their condition. The whole period of their existence is characterised by a series of actions and reactions, ever varying, and yet constantly tending to definite ends. The parts of which they consist undergo continued and progressive changes in their size, form, arrangement, and composition. The materials which have been united together, and fashioned into the several organs, are themselves severally and successively removed and replaced by others, which are again in their turn discarded, and new ones substituted; till, in process of time, scarcely any portion of the substance originally constituting these organs, remains as a component part of their structure.

This continued renovation of the materials of which the body consists, takes place in the most solid as well as in the softest textures; and so great is the total amount of these changes, that doubts may very reasonably be entertained as to the identity of any part of the body at different epochs of its existence. A period of seven or eight years was assigned by the ancients as the time required for this entire change of all the materials of the system; but modern researches, which show us the speedy reparation of injured parts, and the rapid renewal of the substance of bones that have been tinged by madder given to animals with their food, render it extremely probable that a complete renovation may actually take place in a much shorter period.

General as this law may appear, it is subordinate to another and more universally controlling principle, to which all beings endowed with life are subjected, namely, the *Law of Mortality*. Every living being has a period assigned for its existence. With the germs of life are intermixed the seeds of death; and, however vigorous the growth of the fabric, however energetic the endowments of its maturity, we know that its days are numbered; and that even if it should escape destruction from causes that are accidental and extraneous, it is sooner or later doomed to perish by the slow, but unerring operation of natural and internal causes, inseparable from its nature, and coeval with its birth.

In tracing the gradual succession of phenomena that mark these eventful changes, and constitute the numerous and almost insensible steps of transition which connect them, a multitude of interesting topics of inquiry present themselves. Much instruction is afforded with regard to the physical laws of the animal economy, by the study of that condition in particular of the system, in which it has passed its meridian state of activity, and may be regarded as on the decline; and in which the causes that ultimately conduce to its destruction begin to prevail over the conservative powers that had hitherto predominated. Such is the state which is emphatically denominated AGE.

As youth is the state of transition from infancy to maturity, so age is the state of transition from maturity to decay. In the early periods of life, all the powers of the system are directed to the building up of the frame, and of the different organs; to their extension, consolidation, and perfection; and to their adaptation to the performance of their several functions. The exertions made for the attainment of these objects are great, and commensurate with the magnitude and importance of the design; and they give rise to a rapid and varied succession of changes. An abundant store of materials is wanted for these operations; and although the consumption and renovation of these materials be considerable, yet the supply much exceeds the loss; and the body, accordingly, continues to augment in bulk. In course of time, these opposite processes of reparation and decay approach nearer to an equality, and, at length, are exactly balanced. The parts then cease to grow; the system has reached its state of maturity; and the object of the vital powers and functions is now to maintain it in a uniform condition of health and vigour, qualified for the exercise of all its physical and mental faculties. It cannot but excite our admiration to contemplate the accuracy of the adjustments by which these objects are so perfectly accomplished, and that equilibrium preserved, with such wonderful constancy, for so long a period of years.

But at length there comes a season when the balance, hitherto so evenly kept, begins to incline; the powers of the system are less equal to the demands made upon them; a diminution of energy becomes sensible; and the waste of the body exceeds the supply. Yet nature is far from abandoning her work: new arrangements are made, and new provisions resorted to for accommodating the system to these changes. In proportion as the supply of materials for repairing the waste of the organs becomes less abundant, a more strict economy is adopted; the resources of the system are husbanded with greater care; and the functions thus appear to go on for a considerable period without any material or very manifest alteration. Yet all this time the changes which are going on, though insidious, are no less real. Old age steals upon us by slow and imperceptible degrees, which, even when obvious to others, are often unknown to ourselves. Nature, when the system is entrusted wholly to her laws, thus kindly smooths the path along which we descend the vale of life, and conducts us by easy stages to our destined place of repose. But the number of those who thus gently glide along the stream of years is small indeed, compared with those whose declining age is withered by infirmities or embittered by disease. The "Age that melts in unperceived decay" is rarely met with amidst the numerous and diversified causes of premature decrepitude, to which man, in his civilized condition, is obnoxious.

Various and complicated as are the changes which the system undergoes in passing from the state of maturity to that of old age, and thence to decrepitude and dissolution; and, different as are the objects which nature appears to have in view in the several periods of life, it is probable that a minute inquiry into all the circumstances that mark these epochs, will reveal to us the continued and uniform operation of the same principles throughout the whole succession of these changes. The experience we possess of the plans and operations of Nature in other instances is altogether in favour of such a hypothesis. But in order to form a proper estimate of the degree of confidence to which it is entitled, we must examine the exact nature of the progressive changes which have been observed to take place by age in the several classes of textures and functions composing the animal economy.

In this inquiry our first attention will naturally be directed to the mechanical properties of the several textures. The most superficial view of the subject will suffice to impress us with the great difference that exists in the relative proportion of fluids and solids in the earlier and in the later periods of life. The primitive condition of the embryo is, in all animals, that of a gelatinous pulp. In this pulp we trace, by degrees, the formation of filaments and membranes: these extend and are fashioned into organs of various kinds, which long retain their original softness of consistence and imperfect cohesion. The accretion of new materials imparts to them, in process of time, greater density and firmness. The proportion of solid matter that enters into their composition thus continually augments; the body expands in all directions, and soon requires some mechanical basis of support. This support is provided in the osseous structures that are now superadded; at first only partially, and in detached masses; but these are afterwards united into a connected framework of bone, which continues to receive developement during the whole period of the growth of the body. The softer textures are at the same time gradually consolidated, and acquire a higher degree of elasticity: while they, in the same proportion, become less flexible and less extensile. All the parts that are principally formed out of the cellular tissue exhibit these changes most remarkably. They are very perceptible in the membranes, ligaments, tendons, and cartilages; and they may be traced even in the muscles themselves. The condensation of all these parts proceeds as age advances, and is then attended with a general contraction of their dimensions. All the parts composed of fibres acquire toughness by age. This is matter of common observation with regard to animals that are used as food; the flesh of old animals is less easily torn asunder by the teeth, and is less digestible by the stomach, than that of the same species when young. In very old animals, parts that had originally been muscular, appear, by a change of substance, to be converted into tendons; a denser material being substituted for the proper muscular fibre.

The deposition of a bony material in various structures to the purposes of which it is quite foreign, and where, consequently, it appears to be misplaced, is an extreme instance of the same tendency to increased density of texture. Ossification takes place, in advanced age, in various membranes, in the coats of the blood-vessels, in the coverings of the viscera, and more especially in tendons and cartilages. A similar change affects even the bones themselves; for they become harder and more brittle in the progress of age. The tendency to ossification, arising from the redundance of osseous matter, is occasionally so great as to lead to the formation of osseous tumours in various parts of the body. In this respect, therefore, the bones differ from almost all the other parts of the body; for while the latter shrink and contract in their dimensions by age, the bones, on the contrary, have a tendency rather to augment in size, or at least to increase in the quantity of solid materials which compose them. Those bones, which, in the adult, are detached, are frequently united in advanced life: such as those of the sternum and of the skull, the sutures of which are commonly obliterated, first on the inner, and lastly on the outer surface; so that, at length, almost the whole cranium consists of a single bone.

But even when not converted into bone, the fibrous structures lose their flexibility by age, and acquire a degree of rigidity which often disqualifies them for the performance of their usual functions. The joints of old persons become less pliable from changes of this kind taking place in the synovial membranes and the surrounding ligaments. The intervertebral cartilages undergo, by age, a similar process, which impairs considerably the flexibility of the spinal column, and contributes to the bending forwards of the body and to its diminished stature. It has been observed of the fibrous tissues of old persons, that they assume a deep yellow colour, indicating the condensation of their substance, and resembling what takes place when they are artificially dried.

From a consideration of these and other circumstances, the general fact may be considered as established, that the proportion of fluids in each organ, and also in the body generally, diminishes as we advance in life. This remark applies more especially to the general mass of the blood; but it holds good also with regard to all the other fluids: and we can scarcely doubt that a considerable proportion of those peculiarities that characterise the period of senility may be traced to the long continued operation of this principle.

Together with the mechanical changes of texture we have now described, we find that there also take place considerable alterations in the chemical condition of the fluids and solids of the body. In the fœtus and the infant there exists a large proportion of water and of gelatin: phosphate of lime is but little abundant, and fibrine is but scantily developed. These two latter elements increase in quantity as the growth of the body proceeds. On the other hand, as age advances, the gelatin gradually disappears, or at least bears a much smaller proportion to the other animal constituents, namely, the albumen and the fibrin; the aqueous portion is much diminished in quantity, and the phosphate of lime, as before remarked, often accumulates in an excessive degree. Not only is the quantity of gelatin diminished, but it appears to undergo an alteration in its quality by the effects of age. Glue obtained from young animals is found to differ essentially from that which can be procured from old animals. Calves'-feet jelly is not the same with the jelly afforded by the feet of the full-grown ox. The latter has a deeper colour, is less digestible, and passes more slowly into a state of putrefaction. A similar remark applies also to the fibrous textures themselves, which become yellow by age, are less easily resolved by maceration, and resist putrefaction for a much longer time than the same parts taken from young animals.

If we next examine the changes which the secretions undergo, we shall find that they partake of the general diminution of fluidity incident to old age. Those that consist chiefly of the watery exhalations of the blood are more scanty than in early life. The perspiration, for instance, is far less abundant. A deficiency of lymph is perceptible in the cellular tissue; and the lymphatic vessels, having less fluid to convey, shrink in their diameter: and a large proportion of them, becoming useless, are obliterated and lost. The same takes place with regard to the lymphatic glands, which, from being large and turgid in infancy, are smaller and more compact in the adult, and either become ossified or entirely disappear in old age. The blood itself becomes darker coloured in advanced life. From the diminution of perspiration, less animal matter is excreted by the skin, and more is carried off by the discharges from the mucous surfaces. We may probably ascribe to this cause the fœtor which is so often attendant on the breath of old persons. From the same cause the urine is generally higher coloured, more odorous, and more prone to calculous deposition. From the mucous membranes of the nose, fauces, trachea, and lungs, there is frequently, indeed, a disposition to more copious secretion than exists in a less advanced age; but this ought rather to be regarded as a state of chronic disease than as the natural condition of the parts. When it prevails, however, the mucus poured forth is opaque, viscid, and tenacious; and its abundance proves a source of continual distress to the aged valetudinarian by the obstruction it occasions to free respiration, and by the perpetual efforts required for its expulsion.

The integuments, being the parts of the body most exposed to observation, exhibit more distinctly, perhaps, than any other, the changes induced by age. It is doubtful whether the cuticle, which of all the textures seems to partake the least of vitality, and which has even been considered as wholly inorganic, suffers any other alteration in process of years, than that of becoming somewhat thicker and more dry, and more disposed to peel off in scales. Compared, indeed, with its structure in infancy, when it is very thin and delicate, and allows of the ready transmission of impressions to the subjacent nerves, the cuticle of the aged presents a striking contrast; but between the aged and the adult the differences, in these respects, are scarcely perceptible. The principal changes that take place during the transition between these latter periods are observable in the subjacent textures. The corpus mucosum acquires by age a darker colour, as well as greater condensation. The cutis vera, also, exhibits greater density and toughness; while it loses in the same proportion its extensibility, and power of accommodation to the size and figure of the parts it covers. The difference in the texture of the skin at different ages is very perceptible to the dissector; and both the scalpel which divides the skin, and the needle employed to sew it together after division, meet with considerably greater resistance in old than in young subjects. As it no longer adapts itself to the alterations of position or of bulk which occur in the subjacent parts, it becomes flaccid and wrinkled whenever these parts diminish by age. All this is very perceptible in the face, neck, and hands. Hence we may trace the gradual shrinking and corrugation of the features, which regularly follow the progress of years, and which afford unerring indications of age. Witness the dark coloured furrows of the cheeks and lower part of the face, the result of reiterated impressions from various passions, of which the predominating effect is to draw down the corners of the mouth, and compress the nostrils: witness the lesser lines on the temples, radiating from the eyes, and denoting the increased efforts which accompany the employment of those organs: witness, also, the deeper wrinkles in the brow and forehead, bearing the impress of intense and anxious thought.

Grey hairs, the proverbial attendant upon age, exemplify the operation of the same principle of defective nourishment and suppressed secretion. Early and vigorous in their growth, the hairs of the head are generally the first to show symptoms of decay. Great differences may, however, be observed in different individuals, as to the period when the hair exhibits a change of colour, or falls off. In some, it grows grey at thirty years of age, or even earlier; with others, this change does not take place till other and less equivocal indications of age are manifested. Many causes which affect but little the general constitution, accelerate the death of the hair; and more especially the depressing passions, intense thought, and corroding anxieties. Fevers are often destructive of the vitality of the hair, when they do not permanently affect any other part of the body. There is, however, an essential difference in the effects of disease and of old age upon hair, inasmuch as the former seldom destroy the bulbous capsule from which the hair is formed; and, accordingly, a new crop of hair is often found to spring up, after a certain time, when the system recovers its vigour. But the death of hair from age is hopeless and irretrievable, for it implies the destruction of every part of the root, as well as the shaft; and the consequent separation of the hair is attended with the obliteration of the canal which it occupied, and which penetrated the true skin.

The loss of colour in hair begins in the shaft, which first becomes grey, then white, and lastly transparent, giving to it that silvery appearance which is esteemed so venerable a mark of age. Baldness generally commences over the upper parts of the temporal and occipital bones, particularly in the male sex; and thence spreads over the whole upper surface of the head. The hair on other parts of the body suffers corresponding changes with those of the head, and also falls off partially by age.

The alterations which take place in the eyes by the progress of age afford another instance of the tendency to a diminution in the aqueous constituents of the body. As the quantity of the aqueous humour in the anterior chamber of the eye diminishes, the cornea necessarily becomes less prominent, and its curvature being thus diminished, it ceases to have the same refractive power. The vision of near objects becomes indistinct; because the rays proceeding from them, and arriving at the cornea with a sensible degree of divergence, are not sufficiently refracted to enable them to meet in a focus upon the retina: and the images there formed are, consequently, confused. Such is the condition of the presbyopic eye, requiring the assistance of a convex lens in order to supply this deficient power of convergence.

There is, however, great reason to believe that the mere change of convexity of the cornea is not the sole, nor even the principal cause of the incapacity of the presbyopic eye to see near objects distinctly: for this defect is more connected with the diminution in the powers of adjustment in the eye, owing to impaired muscular power.

Changes also take place in the more internal parts of the eye by old age; the crystalline lens generally acquires a yellow or amber colour; and its transparency diminishes. The sensibility of the iris is impaired; and the pupil is habitually more dilated than formerly. The pigmentum nigrum has been known to lose its colouring material, and to become almost transparent. This, as well as the larger aperture of the pupil, have been considered as special provisions of nature for admitting more light to the retina, in compensation for the diminished sensibility of the nerves of vision.

It is probable that the various parts of the internal ear are affected by the progress of age. The fluid which occupies the internal cavities is said to be gradually absorbed, so that at length it is found to have entirely disappeared. Whenever this happens, it must of course be productive of irremediable deafness. But many other causes, which relate to other branches of our subject, may contribute to the tendency to deafness incident to advanced life.

Among the causes of the changes that take place in the internal organs, the most important is the alteration in the condition of the blood-vessels. Not only does the proportion which the blood-vessels, taken altogether, bear to the whole bulk of the body, undergo a gradual and progressive diminution from infancy to youth, from youth to manhood, and from manhood to old age; but a material alteration takes place, during these successive periods, in the relative disposition of the several classes of vessels among themselves. While the body is extending in growth, the arteries are exceedingly numerous, and pervade every part; but in proportion as that extension approaches to its limit, they contract in their diameter, being less capable of dilatation in consequence of the increased density and rigidity of their coats. This contraction is chiefly perceptible in the smaller arteries; a number of the minuter vessels become impervious, and gradually disappear, or assume the form of ligamentous filaments. The sanguineous appearance which is common to so many parts in youth is altogether lost. Few red points are seen on separating the periosteum from the bones, or the dura mater from the cranium, in old subjects; and scarcely any blood issues on making a section of these bones. In making anatomical injections, we always succeed best with young subjects; in the old, we can often do no more than fill the arterial trunks, from the resistance that is opposed to the passage of the injection into the lesser branches. The coats of the arteries themselves appear destitute of the vessels which are proper to them, and which are so conspicuous at a less advanced age.

But this obliteration of so large a proportion of minute arteries and capillary vessels, generally, is accompanied with a greater comparative dilatation of the veins. The coats of the veins are originally thinner than those of the arteries; and as they do not partake of the changes which we have described as taking place in the arteries, they come to differ more and more from the latter in their texture, as age advances. Instead of thickening and contracting, it would appear, indeed, that they became rather thinner and more dilatable than before. This perhaps arises from the coats of the veins having a smaller proportion of cellular substance interposed between them than the coats of the arteries; they, therefore, scarcely participate in the increasing condensation of that substance, but are more under the influence of the action of the absorbents. Certain it is that in extreme old age the veins are very full and prominent, and their course more tortuous: their total capacity must therefore be increased. Hence, while the total quantity of blood in the body is diminished by age, a greater proportion of the whole mass is contained in the venous than in the arterial system. In youth this proportion was nearly equal; in age the veins contain, perhaps, two-thirds of the mass of blood.

Much light has been thrown on the changes that take place in the texture of the different classes of blood-vessels by the researches of Sir Clifton Wintringham, whose experiments have clearly proved the greater proportional density of the coats of the arteries to that of the veins in old than in young animals. Hence it follows, as a necessary consequence, that they must yield more easily to the distending forces of the circulation; and hence, whenever a plethoric state of the system occurs, that fulness will, in youth, affect more the arteries, and, in age, the veins. It is on these principles that Cullen founded his celebrated and beautiful theory of hemorrhagy, which gives so natural and satisfactory an explanation of the prevalence of arterial hemorrhagies in the earlier periods of life, and of venous hemorrhagies in the later periods. Hence, also, the greater frequency of hemorrhoids, and of sanguineous apoplexy in the old.

The veins of the inferior extremities are very liable to varices in advanced life; and they are generally more dilated than those of the arms or other parts; for the pressure of the column of blood they have to support is a force which constantly operates to distend them, and which, when their strength is diminished by age, they are unable to withstand. This proneness to varix is particularly observable in elderly women who have borne many children, from the frequent dilatation the veins have experienced in consequence of the pressure of the gravid uterus. It is remarked by Bichat, that, while young subjects are preferable for tracing the course of the arteries, anatomists should choose old bodies for studying that of the veins.

It appears, also, that the growth of the heart does not keep pace with that of the sanguiferous system; and we may presume, therefore, that its force does not increase in the same proportion with the increasing density and resistance of the solids. This gradual alteration in the balance of the forces of propulsion and of extension, that takes place during the growth of the body, is continued in after life, and is one of the primary causes of the observed phenomena of age. The diminished energy of the heart, in these later periods, is manifested by the languor and slowness of the pulse, which becomes, at the same time, apparently more full; occasionally we find it intermittent, indicating the diminished irritability which pervades the system, and in which the heart at length participates. In old persons the number of pulsations in the minute often does not exceed fifty, and is sometimes even less than this.

The consequences resulting from the diminished energy of the circulation, and the deficiency in the circulating fluids, are sufficiently obvious, and may be traced in all the functions. Not only will less blood be sent to the several organs, but the blood that is sent, is, perhaps, less completely acted upon by the air in respiration, on account of the diminished proportion which is transmitted through the pulmonary system of vessels. The diminution of secretion, and the deterioration of the fluids prepared by the secretory organs, are direct consequences of these changes. The function of digestion itself, the source of those materials from which the blood is prepared and its losses replenished, and from which all the parts derive their nutriment, is less effective than formerly. On the whole, however, the changes that take place in the secretions, and in the powers of digestion, are less considerable than those that occur in other functions. The liver and kidneys, for example, are nearly as active, and perform their respective offices as completely in age as in maturity, and while the muscular and nervous powers have sensibly declined. An exception occurs, indeed, with regard to the secretions subservient to generation, which, together with the generative powers, entirely cease after a certain period of life, which varies considerably in different individuals. In the male sex, after the functions of the testes have ceased, an absorption frequently commences in these glands, which shrink, become soft and pulpy, and sometimes almost wholly disappear. The prostate gland, and especially the posterior lobe, is exceedingly liable to a morbid enlargement. In the female, the ovaria shrink in size, and lose their vesicular structure. The mammæ, when not affected by scirrhous indurations, are also softer, less elastic, and frequently pendulous; but in advanced age they are often totally absorbed, and even the nipple is scarcely apparent. The areola generally assumes a darker colour, even prior to the period when menstruation ceases.

This increased activity of the absorbent system may, on the other hand, be considered as a compensation to the diminished power of the sanguiferous system. The absorbents seem to retain their powers for a longer time than the heart and arteries; and their disproportionate action is the occasion of many changes, that take place in the form and bulk of various parts. It is one principal cause of the general consolidation and induration of the organs. It is productive of a state of comparative emaciation, from the removal of the fat, which, in the adult, is interspersed very largely in the subcutaneous cellular texture, as well as in many other more internal parts. The effects of the loss of adipose substance are very visible in the countenance; the eyes retreat into the sockets, the cheeks become hollow, the teeth decay, loosen, and drop out, the gums and the alveoli themselves are reduced by absorption; all combine to alter the features, and transform their expression to that which characterizes age. The lower jaw, deprived of its teeth, advances, so that the chin projects, and comes nearer to the nose; and the cavity of the mouth being thus diminished in its capacity, the tongue often appears too large to be contained in it. Amidst this general change in the configuration of the bones of the face, the nasal cavities remain undiminished in their size.

At a still more advanced period, however, we frequently have occasion to observe a failure of action in the absorbents, and a consequent tendency to dropsical accumulations.

So intimately are all the functions of the animal economy linked together in one harmonious system, that a change made in any one of them must necessarily affect all the others, by disturbing the nice balance which is established by nature between them. Hence the difficulty that must always be felt in tracing to their origin the long and complicated series of changes that constitute any considerable alteration in the state of the system: and when, as in the present case, the inquiry relates to alterations that are extremely gradual, and extend over considerable periods of time, we are still less likely to arrive at any certain conclusion. Thus, after prosecuting our induction of facts to the length of establishing certain leading principles, according to which the slow progress of years affects the different organs and functions of the body, we find great difficulty in proceeding farther in their generalisation, and in reducing them to a single principle. We have seen, for example, that a great number of changes occurring in the body by the lapse of years imply the operation of a general consolidating cause, affecting both the solids and fluids, and exerted especially on the cellular and membranous textures, which appear to be primarily acted upon, and through which all the parts into which the cellular texture enters as a principal component part, become also more and more condensed as age advances. The gradual diminution of the energy of circulation, and the obliteration of the minuter vessels, constitute together another general fact, which includes a large proportion of the phenomena characterizing the transitions from the earlier to the later stages of life. Now it may be proposed as a question whether these two causes, while they act conjointly, act also independently of one another; or whether the one is not an intimate and necessary consequence of the other. Is the closing of the capillary arteries, it may be asked, the effect of the tendency which the animal fibre has to progressive condensation; or is not this condensation the effect, rather than the cause, of the diminished impetus of the circulating fluids incident to age? Again, if we admit this last hypothesis to be the true one, then we have still farther to seek for the cause of this diminution of force in the circulating fluids: and this brings us to another step in the investigation, namely, the inquiry into the changes which take place, in the progress of life, in the muscular and nervous powers.

The muscles are found to undergo, in the course of years, changes as considerable, though perhaps not so obvious, as the other textures. They participate in the condensation incident to the cellular texture that enters so largely into their composition, and which, as has already been pointed out, frequently acquire, by the deposition of fibrous or even osseous matter, the density of tendon or of bone. This excess of density in the cellular membrane, that invests the muscular fibres, is itself an impediment to the free contraction of those fibres, which are, therefore, from this cause, performed more slowly. But independently of this, a change also takes place in the muscular fibres themselves: they become more rigid, and the total size of the muscle is diminished. Its contractility is also impaired; so that it is less readily as well as less powerfully influenced by stimuli. The muscles of voluntary motion are less under the control of the will; and the involuntary muscles execute their functions with diminished energy.

Not only is the irritability of the muscle impaired, but also that property which has been denominated its *tone* is diminished. The texture of the muscles of elderly persons is loose, flabby, and relaxed: this flaccidity is perceived more especially in the thick muscles of the lower extremities, as the glutæi, the solæi, the gastrocnemii, and biceps muscles; while, at the same time, the individual fibres of those muscles are, in themselves, tough and dense. A greater degree of vacillation characterizes the actions of the muscles of the limbs in advanced age. Hence the tottering and uncertain gait of the infirm old man. Bichat observes that this irregular action of the muscles is generally accompanied by a deterioration of their substance, indicated by greater paleness, and the assumption of a light yellow colour, as if an approach was made to their conversion into sebaceous matter. He remarks that this change is more commonly observed to take place in the deep-seated muscles of the back, which occupy the longitudinal spaces between the processes of the vertebræ; and that it does not affect the muscular system generally, but only a small number of isolated muscles. (*Bichat.* Anatomie Générale, tom. iii. p. 336.) The same phenomenon has been noticed in muscles that had long been affected with paralysis.

The prevailing diminution of muscular strength is manifested, very unequivocally, in the affection of the voice, which, in old age, becomes shrill and tremulous; and the

> "Big manly voice,
> Turning again towards childish treble, pipes
> And whistles in his sound."

A diminution of tone is also exhibited in the muscular coats of the alimentary canal; the stomach and intestines are habitually more dilated; that is, they do not so readily contract upon their contents, when but little is contained in them. The same is the case with the bladder, which remains large, even when void of urine. The diminution of power in the muscular fibres of the bladder is productive of a double evil; as it is rendered less capable of retaining the urine when distended, and also less capable of completely emptying itself. Together with this want of power, the bladder often gets irritable in advanced life: and to this increased irritability the enlargement of the prostate often contributes, by impeding the action of the sphincter, and lessening the diameter of the canal of the urethra.

But muscular contractility is itself intimately connected with the condition of the nervous system; and before we can form a proper estimate of the causes that occasion the decline of the muscular powers, we must take into consideration those that affect, in corresponding periods, the nervous powers.

The structure and composition of the brain undergo, by the progress of age, changes no less great and important than those that affect other parts. The substance of this organ, at the time of birth, is almost fluid; so that, when taken out of the cranium, it has hardly sufficient consistence to retain its figure. As the body grows, it acquires greater consistence and firmness; in the same proportion, we may observe that a smaller quantity of blood circulates in its vessels. In the progress of life this condensation still proceeds, and the subdivisions of that organ are more distinctly marked; hence, in advanced age, the brain becomes better adapted for the anatomical study of its minuter parts. The distinction of colour between its medullary and cortical portions is more strongly marked, and is particularly visible in the optic thalami, the corpora striata, the cornua ammonis, and in that portion of the lower part of the third ventricle which gives origin to the peduncle of the pituitary gland.

An alteration also takes place in the chemical properties of the substance of the brain; Bichat remarks that chemical re-agents act more slowly upon the brain of the adult than upon that of an infant. This is more particularly the case with the dissolving power of alkalis, which is much less in the former than in the latter. The blood-vessels and membranes of the brain become more tough and rigid, and are often incrusted with osseous deposits. The dura mater is easily detached from the inner surface of the skull, in consequence of the obliteration of most of the vessels that established a connexion between them. It is only at the sutures that it remains attached: and even there the connexion becomes less firm as the sutures become themselves obliterated by the progress of ossification. The pia mater and tunica arachnoides acquire greater thickness; and the former presents a redder appearance than formerly; a circumstance which offers a marked contrast with the diminished quantity of blood in the sinuses and neighbouring parts. In general the whole mass of brain is diminished in size in advanced age, so that it does not completely fill the cavity of the *cranium*. Sometimes, indeed, a contrary change to that above described is observed to take place, the brain of very aged persons being found in a softer and more flaccid state than in the adult; but this should be considered rather as a diseased state than the natural effect of age.

The nerves undergo changes from age very analogous to those of the brain; though, perhaps, less distinguishable, in consequence of the membranous covering with which each of their filaments is invested. The proportion of nervous matter appears to be diminished; as is certainly the case with the number and size of their blood-vessels. The ganglions connected with the nerves become harder, and of a deeper grey colour, and shrink considerably in their size.

The functions of the several parts of the nervous system are, doubtless, dependent on their organization; but no knowledge we have been able to obtain of the nature of that organization from anatomical inquiry, or from any other mode of investigation, has thrown any light whatever on the mode in which these functions are conducted. We cannot, therefore, predict, except in the most general way, what modifications of function will result from any observed alteration of structure in this system. All the knowledge we can attain on this subject must be that derived from direct observation, and from induction of the facts so obtained. Now, the whole series of phenomena that characterize the decline of life, indicate the gradual diminution of the energy of the nervous system in general, and of the brain more especially. All the sensitive functions are performed less perfectly. The organs of the external senses become less capable of receiving impressions from their respective objects; the nerves transmit more tardily and more feebly these impressions to the brain; and the perceptions to which the transmitted impressions give rise are less vivid and more transitory than formerly.

The sensibility of the system generally is diminished by age. Bodily sufferings, from the same causes, are less acute; and equal injuries excite less constitutional disturbance; inflammation is more languid. Painful affections, such as cancer, are felt less acutely in age than in the meridian of life, and these, as well as all other diseases, have a disposition to assume a more chronic character. The system is less susceptible of the action of contagions of all kinds; and if, by a certain age, it has not gone through the usual course of exanthemata, and other diseases which affect the body only once in the course of life, it generally escapes them altogether.

The temperature of the body is probably lower in age than in youth. An explanation of this fact has been sought for in the diminution of the quantity of fat, which, by its non-conducting properties, prevents the escape of heat from the body: but it seems more reasonable to account for it by the decline of the powers both of the circulation and of the nervous energy in general. Whatever be the cause, chilliness is a very common attendant on old age. It might, perhaps, be concluded, from reasoning *à priori* on the facts already stated, that the more easy exhaustion of the sensitive powers would call for a greater proportion of sleep, in order to restore and maintain them. Yet we find, in reality, that old persons sleep less than those that are young, and that their sleep is much less profound, and oftener disturbed by dreams. Probably, the explanation may be found in that law of the economy which appears to regulate the quantity of sleep by the necessity that exists for nutrition. Thus, when the body is growing, as in young children, sixteen hours out of the four-and-twenty are passed in sleep. Adults sleep, on an average, seven or eight hours; but for the aged, five or six hours are generally sufficient. Many exceptions, indeed, occur to this, as well as to every other rule in which the operations of the nervous system are concerned; and especially in those depending so much upon habit, which is justly esteemed a second nature. Persons of great age sometimes experience very distressing wakefulness; this is often the effect of cold feet, indigestion, or other internal sources of irritation.

The mind, as well as the body, is wasted by time. The first indication of diminished vigour in the intellectual faculties is usually the decay of the memory. The power of recollection, which is immediately dependent upon that of association, appears to have a closer relation to the physical condition of the *sensorium*, than any other of the mental faculties: for we often observe a failure of memory, while the judgment continues unimpaired. This loss of power is chiefly felt in the case of new associations. Thus recent events are recalled with much greater difficulty than old ones; and new habits can hardly ever be contracted. The earliest notice that is given of this partial decline of the faculties is generally in the forgetfulness of the names of persons. When carried somewhat farther, the names of things are with difficulty recollected. The mind loses that command of language which it formerly possessed; hence the tardiness of speech, and heaviness of expression which characterize the conversation of so many persons of advanced age. The garrulity of old persons is also frequently a consequence of the deficiency of memory, which effaces the recollection of what has just been said, and leads to continual reiteration of the same ideas.

Not only are the bodily feelings impaired by age; the mental sensibility is also blunted, in at least an equal degree, in all that relates to present or recent impressions. Yet it has often been remarked that old persons feel acutely the loss of former friends and companions. How often do we not witness the survivor of an aged couple soon follow his partner to the tomb! The failure of the sight, of the hearing, the senses which connect us most largely with the external world, contribute much to the diminished exercise of the intellect, by abstracting the occasions for exertion; and we well know that, without exercise, the intellectual as well as the bodily powers stagnate and become torpid. To this cause are often added impediments to bodily exertion arising from rigidity of the membranes, stiffness of the joints, debility of muscles, and impaired nervous energy. The tottering steps and tardy movements of the infirm old man can be accompanied with none of the enjoyment which attends the exertions of limbs animated by the elastic spring of youth. If, under these circumstances, he should unfortunately be deprived of the resources of mental cultivation, can we wonder that he is driven for refuge to the enjoyment of those senses of taste and smell that yet remain; and that he devotes himself to the cultivation of the pleasures of the table, and the artificial excitation of spirituous liquors? Yet even here nature imposes certain limits, beyond which the votaries of luxury are forbidden to pass.

> "Time hovers o'er, impatient to destroy,
> And closes all the avenues of joy.
> In vain their gifts the bounteous seasons pour,
> The fruit autumnal, and the vernal shower;
> With listless eyes the dotard views the store,
> He views, and wonders that they please no more.
> Now pall the tasteless meats and joyless wines,
> And luxury with sighs her slave resigns."

Need we pursue this "strange eventful history" to the last melancholy chapter of man's existence, and contemplate the wreck of those exalted faculties which ennoble his nature, and of which the deprivation lowers his condition far beneath that of the beasts of the field? Need we dwell upon the sickening spectacle of "second childishness and mere oblivion;" and disclose those mournful contrarieties of our nature, that drew forth the exclamation from the poet —

> "In life's last scene what prodigies surprise?
> Tears of the brave and follies of the wise.
> From Marlborough's eyes the streams of dotage flow,
> And Swift expires a driveller and a show."

Let us rather draw a veil on this humiliating picture of the frailties incident to humanity, and which forcibly remind us of what

> "We shun to know,
> That life protracted, is protracted woe."

To revert, then, to the philosophical question which has already occupied our attention, let us inquire whether it is possible, throughout the multifarious changes we have described as characterizing the several stages of the transition from infancy to decrepitude, to discover the uniform and progressive operation of any single principle. Admitting that the increasing density of the cellular substance is the natural consequence of the diminished force of circulation, aided, perhaps, by the increased, or, at least, undiminished power of absorption, may we not advance a step farther, and ascribe the diminution of the force of circulation to the gradual loss of muscular power arising from a decline in the energies of the nervous system? If this be a legitimate inference, then this declension of nervous power, which takes place with more or less rapidity as we advance in life, appears to be the general principle we were in quest of; that is, the ultimate fact to which all others are subordinate. Appearances, then, warrant the hypothesis that a certain stock of vital force is imparted to the embryo at its first formation, as a provision for carrying it through its destined career of existence. In every action of the system a portion of this power is expended; and the greater the expenditure, the less must there be remaining, till, at length, the whole being consumed, all movements cease, like those of a watch which has run down, and of which the main spring has ceased to act.

That considerable differences exist in the stock of vitality originally imparted to the frame in different individuals, cannot be doubted; some being destined to a shorter, and others to a longer, term of existence, independently of all adventitious causes that may occur to disturb the regular course of nature in the demolition of the fabric, and the termination of life; while others, born with more feeble stamina, yet highly excitable, anticipate the natural epochs and stages of life, and, precocious in their youth, are doomed to premature senility and decay. Such is usually the condition of dwarfs, who generally die at an early period, bearing all the ordinary marks of extreme old age.

From all that has been said we may draw the conclusion, that the spontaneous decay of the body, and decline of its powers invariably attending the lapse of years, arise altogether from causes that are internal, and interwoven with the very conditions and laws of its existence, and are but little influenced by external circumstances. With inorganic bodies precisely the reverse takes place; they owe to external causes their decomposition and destruction. But living bodies perish from within, being consumed by the very fire which is itself the source of their animation.

If health be viewed as consisting in the proper balance and harmony of all the functions of life, it is evident that this condition may exist in all ages, and that it is compatible with different degrees of energy in the exercise of those functions. Though the powers of the constitution may be enfeebled by age, and though the actions may be less vigorously performed, yet if they be duly proportioned to one another, the system must be considered as in a healthy condition, and as fulfilling the designs of nature in the latter stages of its existence. In one respect, however, there is a material difference between the health of youth and the health of age; inasmuch as the former is more secure and stable than the latter. In the period of youth, it is true, the greater activity of the functions often endangers the equilibrium of the system; but then the power of restoration is at the same time proportionably more efficient. Rich in its resources, the constitution of youth rebounds with surprising elasticity from the depression of a severe illness, and even seems to gather fresh vigour from the shock. In advanced life, on the contrary, this resilient power is deficient: the fibres that have been stretched beyond the proper limits no longer return to their former state; the spring no longer re-acts with a force equal to that by which it is extended; and a displacement of its particles is productive of a permanent alteration in structure, and of augmented incapacity to perform the same extent of action.

The slighter deviations from the perfectly healthy structure of the organs, which are the concomitants of age, are of various kinds, and their effects may be for a long time insensible. Gradually, however, they increase in extent, until they manifest themselves by some outward indications of disordered health; obscure, perhaps, at first, and apparently evanescent; yet, recurring at uncertain intervals, and acquiring, by degrees, a more decided and permanent character, they at length attract attention; and proper means being resorted to for the correction of the derangement in the functions, the health appears to be again restored.

Still, however, there is left a greater proneness to disorder than before. Various excitements and exertions which formerly were harmless are not so well borne. Slighter causes of disturbance are followed by some particular symptom or sets of symptoms to which there may exist a predisposition in the system; such as head-ach, lassitude, dyspepsia, depression of spirits, palpitation, watchfulness, &c. It seems as if something were going wrong, and preparing more serious illness. Such is generally the progress of structural diseases, which steal on by slow and insidious gradations, producing for a certain interval that undefinable state of impending disorder, which only a very attentive and scrutinizing observation can detect, but which exists long before that eventful period commonly characterized as the *breaking up of the constitution*, or that in which positive disease has commenced its hostile incursions. Then, indeed, all that our most skilfully-directed efforts can accomplish is to repulse the immediate aggression, and obtain a truce from that enemy which is sure to renew the attack, and to whose power the citadel we defend must at last be unconditionally surrendered.

It has been observed that, independently of any positive alteration in the structure of a particular organ, there occasionally occurs, at a certain period of life, a sudden and general alteration of health, which is of uncertain duration, though generally of no long continuance, and to which the term *climacteric disease* has been applied. This peculiar condition has been well described by Sir Henry Halford in an essay published in the Medical Transactions of the College of Physicians, (Vol. iv. p. 316.) This disease, he observes, is better characterized in men than in women; but even in the former the period of its invasion is by no means constant, for it may occur at any time between the ages of fifty and seventy-five. Its commencement is often apparently determined by some occasion of feverish excitement, such as an act of intemperance, a fall which seemed at the moment to be of no consequence, or even a common cold. Sometimes it follows upon a marriage contracted late in life. But the most frequent predisposing cause is mental anxiety and suffering, the corroding influence of which will eventually sap the foundations of the most robust constitution.

The climacteric disease is described, by Sir Henry Halford, as being marked by an extraordinary alteration in the expression of the countenance, by an accelerated pulse, and by a wasting of the flesh, without any obvious source of exhaustion. Wandering pains are felt in the head and chest; the tongue is white, the bowels are sluggish, the nights passed either without sleep, or without the refreshment which sleep should bring with it, and there is a general feeling of lassitude and of fever. There is no deficiency of urine; yet the legs often swell. These symptoms may be of some duration; and may, indeed, proceed so far as to undermine the health to such a degree, that the patient sinks under a disease which seems to have no other characteristic than that of a general failure of the functions. But when, as is most frequently the case, the powers of the system are adequate to recovery, the symptoms are gradually mitigated and disappear. Then is there a return of comparative health and strength, which may last for many years. But we may yet always remark that the energies of the frame have been permanently impaired; and the impression made upon the countenance remains fixed and indelible.

Such is the climacteric disease in its simple form, as it occurs in individuals who have enjoyed previous health. But when it supervenes upon a frame already deranged by habitual illness, it often assumes the feature and partakes of the character of the predominant complaint. When thus associated with the effects of structural disorder, it is always difficult to assign the share that belongs to each specific source of disease; but the existence of the climacteric affection may sometimes be inferred from the peculiar expression of the countenance already mentioned, from the unusual exasperation of the symptoms appertaining to the organic disease, and from its proceeding with greater rapidity to a fatal termination. It is owing to this frequent complication of previous local and constitutional ailments with the evils which are the natural consequences of old age, that the picture above drawn is not often realized in actual observation.

We shall now proceed to point out the more specific diseases to which old age is most obnoxious, and by which life, at that period, is most frequently terminated.

Among the numerous indications of a wavering in the equilibrium of the functions incident to the decline of life, perhaps the most important are the symptoms of disorder in the digestive processes. Dyspepsia, in all its varieties, is among the earliest as well as most common of the diseases of advanced life; and its prevalence at this period may be traced to many causes, of which the operation is sufficiently obvious. The principal of these is, undoubtedly, the gradual decline of irritability and of muscular power which pervades the whole system, and in which the fibres of the stomach and intestines must of course participate. It often happens, that while the powers of assimilation have diminished, the appetite still continues good; and, consequently, more food is taken than can be converted into healthy nutriment. That portion which is imperfectly digested being retained, tends, by its presence and accumulation, still further to impede the due performance of this function. The distension of the stomach and bowels from flatus, and their continued irritation from containing acid or acrid materials, lay the foundation of a vitiated habit, and of permanent injury to the tone of the organs. Another cause of imperfect digestion may be pointed out in the loss of the teeth, and the consequent defective mastication of the food. The mischief is often aggravated by the sudden discontinuance of the salutary exercise which was formerly taken; and by an indulgence in the repose which, after a life of exertion, is almost claimed as the privilege of age.

Increasing sluggishness takes place in the peristaltic action of the bowels, more especially if exercise be neglected. Hence arises a habit of costiveness, and hence are formed accumulations in the large intestines, and more particularly in the cells and flexures of the colon, which acquire a preternatural size from habitual and inordinate distension. In this way the foundation is often laid for structural diseases, which affect the coats, and lead to fatal strictures of the great intestine.

Another and more frequent attendant upon habitual constipation are hemorrhoidal tumours, often productive of much suffering, or profuse and dangerous losses of blood; and leading, not unfrequently, to fistulous abscesses, which terminate in a lingering and fatal hectic.

Protracted dyspepsia may give rise to hepatic disease in all its various forms. The cause by which these affections are most commonly determined, is the abuse of spirituous liquors. If the habit of indulgence in this Promethean poison has been already contracted, it is almost certain to increase during age, when the cravings of this artificial appetite never fail to become more inexorable, and when the power of self-control, together with the other energies of the mind, is generally diminished. Yet, provided a foundation has not been laid for diseases of the liver at former periods of life, either from the cause just mentioned, or from the influence of a hot climate, it does not appear that there exists any particular proneness to this class of diseases in advanced life.

The structural diseases of the liver, like those of other organs, are mostly of a chronic character, stealing on by slow degrees; advancing to a certain point with comparative rapidity; then appearing for a long interval to be stationary: after which they proceed another step, and again stop. As a considerable portion of life may be spent while they are thus passing through their successive steps of aggravation, it is natural to expect that their last and more fatal stage should occur during the later periods of life, and thus appear as the natural attendants upon old age. One cause, however, may be assigned for the more aggravated symptoms, and more rapid course of structural diseases in advanced life; and that is, the greater proneness to chronic inflammation at that period, which may itself be traced to a deficiency of that conservative power which maintains the healthy balance of the circulation. This more diffused and insidious kind of inflammatory action is particularly apt to affect the serous membranes. Hence the aged are particularly liable to those dropsical affections which are the natural consequences of their inflammatory states. The same general principle will account for the ravages of cancer being more observable in the aged than in others. We find accordingly that a large proportion of elderly females are destroyed by cancer of the uterus or mamma; while, in the male sex, the structural disease which more especially manifests itself in advanced life is the enlargement and scirrhous induration of the prostate gland, and especially of its posterior lobe. This latter disease, besides being productive of various local inconveniences, such as irritation of the bladder, and painful obstructions of urine, frequently preys upon the general health, and tends to exhaust the constitution.

The failure of the urinary functions is also among the more frequent causes of distress in old persons of the male sex. The first indication of a tendency to gravel is the deposition of uric acid in the form of crystals, like red sand, in the urine. By degrees concretions are formed in the pelvis of the kidney, giving rise to acute pain, and other nephritic symptoms arising from inflammation and abscesses in the kidneys. When these concretions descend into the bladder, the well-known symptoms of vesical calculus are excited, which need not be enumerated in this place. But independently of calculus, the muscular power of the bladder is liable to be much impaired in advanced life, in a greater proportion than other muscular parts. Two evils, apparently of an opposite kind, yet both referable to impaired action of some of the fibres of the bladder, occur as sources of great inconvenience and distress. The one is retention of urine, from debility of those muscular fibres by which it is expelled; and the other is the incontinence of the bladder, arising from paralysis of its sphincter.

The first indication of a failure in the muscular powers of the bladder is the inability to empty itself wholly; some urine always remaining behind, after every attempt at expulsion. If from some accidental circumstance the urine has been suffered to accumulate in too great a quantity, its expulsion becomes still more difficult, and may even be found to be impossible, without the introduction of the catheter. After the bladder has thus been stretched to an excessive degree, its tone is much impaired, and is with difficulty recovered; and even if the power of retention, to a certain extent, is obtained, this power may be accompanied by incontinence when that quantity is exceeded, the urine continuing to come away involuntarily, while there is still a considerable quantity retained in the bladder.

Gout, though it be not exclusively a disease of age, should be ranked among those to which there is a greater predisposition in the decline of life. Chronic rheumatism, and especially that form of it which has been termed nodosity of the joints, is more prevalent in aged persons than in others.

The organ which participates most largely in the changes induced by age, and which also sympathizes most extensively with the stomach, is the brain; and the diseases of this organ probably constitute, on the whole, the principal source of fatality at the advanced period of which we are treating. The failure of energy in its functions frequently shows itself in the alteration which takes place in the state of mind; in the predominance of more gloomy views of things, in habitual despondency, in increasing listlessness and lethargy, in confusion of thought or loss of memory, in heaviness and somnolency. Old persons are subject to noises in the ears, to occasional head-ach, and giddiness. Partial debility is manifest in some particular organ of sense or motion; the sight or hearing fails; a feeling of numbness, or tingling, is perceived in the extremities; wandering pains are complained of in different parts of the trunk or limbs, which are ascribed to rheumatism, but which are found to follow more the course of the nerves than of the muscles, and are sometimes referred to the centre of the bones. Sudden and unexpected relief is often experienced from these symptoms by the discharge of flatus from the stomach or intestines.

All these are but preludes to an attack of a more serious character. Palsy or apoplexy suddenly supervenes, and either at once carries off the patient, or, if for a time recovered from, leaves him but the wreck of his former self. It has been computed that about one-fourth of all those persons who attain the age of seventy are destined to perish by this disease. It would appear, from a computation made by Dr. Heberden, that apoplexy and palsy have prevailed to a greater extent in modern times than formerly; for the number of fatal cases from these diseases, recorded in the Bills of Mortality, is now double of what it was at the beginning of the last century.

This is not the place to enlarge upon the causes, both remote and proximate, of that class of diseases; it will be sufficient to observe that they appear connected with a local plethoric state of the vessels of the head, and more especially of those belonging to the venous system, in conjunction with the declension of the nervous power. In a large proportion of cases they are accompanied with perceptible structural changes either in the cerebral substance, or in the vessels that supply it. Ossific depositions in the coats of the arteries of the brain are among the most frequent of these changes.

Various lesser degrees of impaired sensibility and muscular energy, occasionally perceptible in different organs, and constituting what is called partial paralysis, are referable to the same causes. Instances occur, in the relaxation of the upper eye-lid, which, in consequence, hangs over the globe of the eye; in the dropping of the underlip, which becomes pendulous, and is no longer able to retain the saliva; in the faltering speech and tremulous voice, and in the relaxation of the sphincter, already noticed.

Cutaneous disorders frequently make their appearance during the decline of life. They would seem in general to be more closely connected with the condition of the brain and nervous system, than with the state of the digestive organs. Of these the most distressing and intractable is the prurigo senilis, which, though unattended with any visible eruption, is often remarkably inveterate, and is the source of incessant and indescribable torment to the individual whom it affects.

The heart is frequently found to be diseased in elderly persons; hence arises another train of diseases, which will be described in their proper place. It will be sufficient here to indicate ossification of the coronary vessels, or of the valves of the heart; increased size of its ventricles or auricles, and dilatation of their cavities; aneurisms or ossification of the coats of the large vessels connected with the heart. Collections of water in the pericardium, the frequent effect of these organic changes, contribute still further to complicate the symptoms and augment the danger to life. All these occasion more or less impediment to the action of the heart; and the consequent disturbance of the circulation shows itself in various ways.

Inflammation in the skin, particularly in the extremities, is exceedingly apt to terminate in mortification during old age. The toes are frequently the seat of this affection. Carbuncle may also be enumerated among the diseases to which there is a more particular disposition in the advanced than in early or middle periods of life.

The last class of diseases affecting aged persons, which we shall notice in this brief review, are those of the respiratory organs. The relaxed condition of the mucous membrane of the bronchi, and the predisposition to a chronic form of inflammation, lay the foundation for those protracted forms of catarrh, of asthma, and of peripneumony, which prevail so extensively in persons of advanced age. In catarrhus senilis, as it is emphatically called, the great abundance of the secretion from the membrane both of the lungs and nasal cavities, and its peculiar viscidity, which demands great efforts for its removal, is the source not only of great distress, but also of great exhaustion of strength; the constitution is frequently unable to withstand the repeated aggravations of this complaint, which take place in successive winters. Under these circumstances, especially the supervention of peripneumonia notha is rapidly destructive of life. The occurrence of that species of epidemic catarrh, at times so widely prevalent, and which is known by the name of influenza, is always extensively fatal to very elderly persons: indeed, all inflammatory complaints affecting the chest are incomparably more dangerous at this period of life. Asthma, which must certainly be enumerated amongst the diseases of age, is not, at first, or in itself, attended with the same risk; though, in its consequences, it eventually contributes to the abridgement of those years during which the life of a person of healthy lungs would otherwise have been prolonged.

P. M. Roget.

AIR, (CHANGE OF.) Change of air is a popular, and when well directed, very powerful remedy, in a numerous class of chronic ailments; in some acute diseases; and in a state of convalescence from disease generally. Its influence also is, perhaps, still more remarkable in removing that condition of the system which may be termed rather a deterioration of health than a formal disease, and which is occasioned by confinement and sedentary habits, or residence in impure air; a complaint which has been termed *Cachexia Londinensis*, although by no means peculiar to the metropolis.

The striking improvement produced in the health by a removal, or a few weeks only, from the tainted atmosphere of a city to the pure and invigorating air of the country, is the subject of daily observation. Even a change from one part of the country to another is often attended with remarkable benefit, and that when there is little or no apparent difference between the two situations.

We use the term pure and impure in this place, because unquestionably the atmosphere in various situations differs materially in its purity, according to the ordinary meaning of the term. It may be true that the air collected in the most confined alleys of London, when subjected to analysis by the chemist, shall afford the same proportion of oxygen and azote as that to be found on the summits of our highest mountains; but we have no reason to believe that oxygen and azote constitute the whole ingredients of the atmosphere. The present state of our chemical knowledge may not, indeed, enable us to determine what is the precise nature of the other ingredients, but we are not the less sure of their existence, and that they often exert a pernicious influence on health. The attempts of chemical philosophers to ascertain the nature of the agents now referred to, which contaminate the air in different situations, and speedily produce specific diseases, or more slowly undermine the health, have hitherto proved most unsuccessful. Even our means of measuring some of the obvious physical qualities of the atmosphere are still very imperfect; so that in treating of them we are often obliged to employ the terms in common use, instead of the more accurate and definite language of science.

[Even the change from a better to a worse air has been found serviceable. In Edinburgh, the inhabitants of the most airy parts of the New Town have frequently sent their children, when labouring under hooping cough, to the Cowgate — a filthy street, which runs at right angles under one of the largest thoroughfares in the Old Town, and in which, at a certain hour in the night, the inhabitants eject all the offensive accumulations from their houses, to be washed away by the water of the reservoirs let on for the purpose.]

Although change of air implies some change of climate, in the extended acceptation of this term, yet by the former expression is commonly meant a removal from one place to another in the same country or climate. And it is in this more limited sense that we use the expression change of air on the present occasion. In another article, the medical effects of different climates, and of change of climate, will be fully discussed. (See CLIMATE.) In the present article we shall confine ourselves to a few practical remarks on the principal circumstances which should guide the practitioner in prescribing change of air, in order that the patient may derive all the benefit from that remedy which his case admits of. It is upon the just adaptation of the remedy to the individual case that all the advantages to be expected from change of air depend.

In designating the predominating qualities of the air in different places, which give to them severally a peculiar character, in reference to their effect on the human body, we shall employ terms in common use, as their import is well understood, and they are sufficiently explicit for our present purpose. The epithets soft and mild, as opposed to sharp and harsh; moist or damp, as opposed to dry; heavy or oppressive, as distinguished from light and elastic, are expressions in general use; and the effects of the conditions of the atmosphere which they indicate, in soothing or exciting, in depressing and relaxing, or in exhilarating and bracing, are well known by experience. The different states of the atmosphere just noticed, exert a more powerful influence in proportion as the constitution is delicate; and, accordingly, change of air becomes a much more important remedy in the diseases of such persons. It is, indeed, chiefly from observing the manner in which invalids and delicate persons are affected by the atmosphere of different situations, that we are enabled to estimate its less powerful influence on the more robust constitution.

Habit, and the conservative powers inherent in the human system, enable man to resist, to a certain extent, the action of the deleterious qualities of the atmosphere; yet no person, however strong may be his constitution, will long remain altogether uninfluenced by them. Their effects are, in general, observable on the organization of the inhabitants of such places, and in the manner in which the various functions of life are performed in a state of health; and they are, perhaps, still more remarkable in the nature and character of the diseases to which such persons are most obnoxious. Although these circumstances are more strikingly observed in the natives of different climates, they are sufficiently evident in the inhabitants of different districts in our island. In proof of this, we need only compare, in the state of health, the firmly-knit frame, the florid countenance, and the elastic motions of the mountaineer, with the sallow complexion and languid gait of the inhabitant of the humid plain, or confined valley. The contrast is equally strong when these individuals are suffering from disease. In the former, we have acute, febrile, and inflammatory affections; in the latter, diseases of slower progress, with comparatively little excitement of the vascular system, but with great sensibility of the nervous system. Were any proof necessary that this difference depended on the locality, we find it in the fact that persons, in removing from one district to another, gradually assume the characteristics, both of health and disease, of the inhabitants of the new locality. For example, the character of the same disease attacking the Welsh mountaineer on his own hills, will be very different from that which he would be subject to after a residence of some time on the southern shores of Devonshire or Cornwall. The physician in the metropolis, who has constant opportunities of seeing patients from all parts of the country, cannot fail to remark how much the character of their constitutions and the nature of their diseases vary according to their place of residence. It is unnecessary to point out the important practical bearing of this observation, which so happily illustrates the well-known remark of Baglivi, "*differre pro natura locorum genera medicinæ.*" But our attention, for the present, must be limited to the consideration of the effects of change of air in remedying disease and improving the general health.

The leading circumstances which require consideration in prescribing change of air, are the nature of the disease, the constitution of our patient, and the quality of air best suited to these. Before noticing these, however, it may be well to make a few remarks on the periods of disease at which change of air can be employed with any prospect of benefit, or even without disadvantage.

In acute, febrile, or inflammatory diseases, it is, of course, during the stage of convalescence only that change of air is proper: but when the convalescence is sufficiently advanced to admit of a removal, and the season of the year is favourable for such passive exercise in the open air as a convalescent can bear, a case will rarely occur in which the return of perfect health may not be materially promoted by such a measure. When the patient resides in a crowded city, or other confined situation, the change is more urgently called for; and, indeed, we feel convinced that, under such circumstances, many cases of severe disease occur, after which complete restoration of health is never effected without a change of air. The person deprived of the benefit of such a measure attains only to a degree of health inferior to that which he enjoyed before the occurrence of his disease; and the remainder of his life is often little better than a state of improved convalescence.

In those acute diseases which are accompanied with little fever, change of air need not be delayed till the patient is convalescent. When the more active period of the disease has passed over, and the danger of creating inflammation is greatly diminished, and more especially when the disease threatens to pass into the chronic form, a judicious change of air will often assist powerfully in putting an end to it. As examples of such diseases, we may mention the subacute forms of bronchitis, catarrhal affections generally, and hooping-cough in particular. But even in these cases the change requires to be well-timed: if too early, it will scarcely fail to *aggravate* the disease; if deferred too long, the disease may have fixed itself in a chronic form, and the measure, consequently, prove much less beneficial than if it had been adopted at an earlier period. It is impossible, however, to do more at present than to call attention to the circumstance; the medical attendant can alone decide upon the proper period of removal in each individual case.

In no class of diseases is change of air so obviously and imperatively called for as those which originate in the pernicious qualities of the air of certain localities, commonly, of late years, designated by the general term *malaria*. The most conspicuous of this class is the numerous family of aguish disorders. In these cases the single measure of change of air is often sufficient of itself to remove the disease; and the more promptly the change is made, the more effectual it is likely to prove. This measure, however, should never be trusted to exclusively in intermittent fever. The disease has been produced by a specific cause, and generally requires a specific remedy for its complete cure. If this be neglected, we shall frequently find that the disease has only been suspended, not cured. The period when the paroxysms are suspended by the removal of the patient from the source of his disease, is the most favourable for employing the proper remedies for securing him against a relapse. Even when the removal does not suspend the disease, it renders it more amenable to the action of medicine; and, were it only with this view, change of air should be adopted in such cases whenever it is practicable. The perfect re-establishment of health is scarcely ever effected in the severer forms of those diseases, as far as our observation goes, without a complete change of residence for a considerable time.

The indiscriminate manner in which change of air is recommended, with little regard to the constitution of the patient, the nature of his disease, or of the place whither he is sent, are the principal reasons why this measure so often disappoints the hopes of the invalid and his friends. It is quite essential to success that the air of the place selected should be suited to the patient. The feeble and irritable invalid will not bear a keen exciting air, whatever may be his disease; whereas the invalid possessing a constitution of an opposite character will feel increased vigour while breathing such an atmosphere. As an example of this difference of result in the same disease, we may refer to bronchial irritation. In sensitive irritable subjects labouring under bronchial disease, we generally find a corresponding state of the pulmonary organs; we have little expectoration, with a disproportionate degree of irritation and cough from the slightest exciting causes. A dry and sharp atmosphere in such cases cannot be borne, while a mild and even humid air often gives relief. In persons of a more languid habit, suffering under the same disease, we find less sensibility of the mucous membrane, and a much more copious expectoration. The same dry and keen air which proves so irritating in the former case is beneficial in this. Were we to prescribe for the name without giving due consideration to the nature of the disease and the constitution of the patient, both these invalids might be sent to the same place, the one to be injured as much as the other would be benefited. What has just been said of bronchial affections is equally applicable to dyspepsia, rheumatism, consumption, and several other diseases. It would be wasting the reader's time to point out the important practical inference to be drawn from these observations.

In recommending change of air, the next circumstance which presents itself for our consideration is, the relative preference to be accorded to a situation in the interior of our inland, or on the sea-coast. The season of the year will assist us in deciding this point. Generally speaking, the more sheltered parts of the interior form the most eligible residences, to all classes of invalids, during the spring and early part of summer: after midsummer, in the autumn, and during the winter, the sea-side affords the best situations. This, however, is only to be considered as a general rule, to which there are many exceptions. Whether the situation selected be inland, or on the coast, the particular characters of its air must be such as are suited to the patient, as very considerable differences exist in places situated at no great distance from each other, both in the interior and on the sea-shore. There are also peculiarities of constitution, which we can only learn from information communicated by the patient. Some persons, for example, never feel well by the sea-side in any situation, or at any season, although to all appearance their ailments are such as we know to be generally benefited by a marine atmosphere; while others improve during a residence on the coast under the most unfavourable circumstances of situation and season.

But there are few persons who require change of air, either with the view of preventing disease, or of removing its effects, that will not derive greater benefit from repeated changes, than from a long continued residence in any one situation, however judiciously selected. The more sheltered and drier parts of the interior during the spring, the more elevated and even mountainous districts in the summer, and the south and south-west coasts of our island during the autumn and winter, afford a succession of changes capable of effecting much benefit in numerous cases in which the other measures of medicine are of little avail. It is to be regretted, however, that but a small proportion of invalids, or of the more delicate of our youth, can avail themselves of a change of air upon so extensive a scale as we have just been contemplating; the rather because it affords one of the most powerful means of improving the general health, and obviating the disposition to tuberculous disease, which we possess.

But here it is proper to observe that the best directed change, or succession of changes, of air, will produce little permanent benefit unless strict attention be paid to regimen, more especially as regards diet. Too much is generally expected from the simple change of air, while little attention is paid to the various circumstances comprehended under the term regimen, although these are equally essential to the restoration to health as the measure from which so much is anticipated. It should be strongly impressed on the minds of such persons as seek benefit from change of air, and more especially upon dyspeptics, the most numerous class of all, that, without adhering to the regimen laid down for them, they will derive but little advantage from the most favourable change of air. Many may, indeed, find their limbs stronger and their general health improved, and even the more urgent symptoms of their disease may cease to prove troublesome; yet all these improvements will too often prove but fleeting, and their return to their usual avocations will soon be followed by a return of their old complaints.

The restricted limits of this article will not allow us to particularize all the diseases in which change of air proves useful; there are few, indeed, to which it is not applicable at some period of their course. The good effects of this remedy, when well directed, in the morbid states of the mucous membrane of the respiratory organs, are well known; and they are scarcely less remarkable in disorders of the digestive organs, and of the uterine system. In the functional derangements of the nervous system, also, whether originating in the diseases just alluded to, or the consequence of sedentary and confined life, change of air will be found a powerful means of restoring the tone of the system. In all these cases, indeed, it is a remedy for which we have no adequate substitute.

[In all diseases in which the affection appears to be kept up by habit, in other words, by accustomed associated actions, and especially in those that implicate the nervous system, the beneficial effects of change of air are proverbial, and are acquiesced in by all observers.

It is probable, that a great portion of the salutary effects ascribed to the waters of fashionable summer retreats is dependent upon change of air, and other extraneous circumstances. Long before the citizen of one of the Atlantic towns reaches the Alleghany springs of Virginia, he has an earnest of the advantages he is about to derive from change of air; and many a valetudinarian finds himself almost restored during the journey, fatiguing as it is, through the mountain regions which have to be crossed before he reaches the White Sulphur, in Greenbrier county. Many persons, too, cannot drink the water with impunity, and are consequently indebted for their improvement chiefly to change of air, but somewhat, also, to varied scenery and society, absence from cares of business, and to greater regularity of living, perhaps, than they have been accustomed to. In making these observations, it is not designed to affirm that mineral waters, as in the case of the valuable spring in question, may not occasionally be important agents in the cure of disease; but, taking invalids in general, we are satisfied that more is dependent upon change of air than upon the administration of the waters. The inhabitant of one of the Atlantic cities, and of most of the districts to the east of the Blue Ridge, removes from a hot atmosphere to one which is comparatively cool, and where all the diseases that are common to hot and malarious climates are extremely unfrequent, and many of them unknown. The advantage is obvious. He escapes the diseases which might have attacked him had he remained through the summer in his accustomed locality; and hence the wealthy families of Lower Virginia are in the habit of spending those months in the mountain regions in which they are especially liable to disease in their own malarious districts. We can thus understand the reputation acquired by the inert Bath and Matlock waters of England, the latter of which has scarcely any solid ingredient; and yet what crowds flock to these agreeable watering-places; to the former, for the perpetual amusements, that keep the mind engaged, and cause it to react beneficially on the corporeal or mental malady; to the latter, for the enjoyment of the beauties of nature, for which Derbyshire is so celebrated. It is obvious, that were such waters bottled, and sent to a distance, so that the invalid might drink them at his own habitation, the charm would be dissolved. The garnitures—more important, in this case, than the dish—would be wanting, and the banquet would be vapid, and without enjoyment or benefit. Less than twenty years ago, amidst the bubbles that were engaging the minds and the money of the English public, it was proposed to carry sea-water, by means of pipes, to London; in order that the citizens might have the advantage of sea-bathing without the inconvenience of going many miles after it. Had the scheme been carried into effect, the benefits from metropolitan sea-bathing would not have exhibited themselves in any respect comparable to those of the same agent employed at Brighton or Margate. (Dunglison's *Elements of Hygiène*, p. 157. Philad., 1835.)

It would seem, therefore, that a mere change of the physical circumstances of the atmosphere in which we are habitually placed, is advantageous to the economy, and that the vital forces act with increased energy, whenever we leave a locality to which we have been long accustomed, and where the functions are executed under the influence of unvaried excitants, and pass to one differing essentially from it. Nor is it always necessary that this difference should be extensive. Sir James Clark remarks, (*The Sanative Influence of Climate*, &c., 3d edit. p. 315: Lond. 1841.) that notwithstanding the uniformity of temperature which prevails among many of the West India islands, the effect of a change from one to another is often very remarkable in improving the health,—a fact frequently observed on a large scale, among the British troops stationed in the West Indies; and he considers, that one of the most powerful means of diminishing the sickness among the troops, in that climate, would be to remove them frequently from one healthy island to another.

The moral and physical effects of change of air, during travelling, have been well depicted by Dr. James Johnson. (*Change of Air; or the Philosophy of Travelling*, &c.; Amer. edit.: New York, 1831.)]

But change of air is not more valuable as a remedy in the cure of disease and its consequences, than as a preventive of disease, more especially in childhood and youth. At this tender and susceptible period of life, the rapid influence of the atmosphere in which we live, in deteriorating or improving the health, is very remarkable; a change of a few weeks from the country to a large town being often sufficient to change the ruddy, healthy child into a pale, sickly-looking creature, and *vice versâ*. The comparative influence of a town and country air on the health of children is seen in a striking manner in the families of the higher ranks of society, who spend a considerable part of every year in town. Children should never be reared in large towns, when this can be avoided; and when unavoidable, they should be sent, during a part at least of every summer, into the country, which, indeed, is the proper place for children, until their system has acquired sufficient strength to resist the injurious effects of city life. When they cannot have this advantage, we consider it the duty of the medical attendants of families to urge a temporary annual residence in the country, as essential to the health of children, more particularly those who are delicate. How many neglect this invaluable means of improving the health of their offspring, who have it in their power, and would willingly adopt it, were they aware of its importance! So strongly, indeed, are we impressed with the value of this measure from ample observation, that we consider parents resident in towns, who have the means of giving their family the advantage of country air, and neglect it, deficient in one of their chief duties. To young females, who, by the habits of society, are much more confined to the house than boys, a temporary annual residence in the country becomes a measure of still greater importance, and should be continued at least to the full period of their growth. We have reason to believe that the advantages of country air to the young and delicate are not yet sufficiently appreciated by the profession, and we are therefore anxious to call their attention to it, that they may use their influence with the public, upon whose minds if they succeed in impressing the full value of pure air, they will be the means of contributing greatly to the health of the rising generation.

James Clark.

ALOPECIA.—The falling off of the hairs, in an unusual degree, from any part of the body naturally covered with them, constitutes the essential character of this disease. The name, which is derived from ἀλώπηξ, *vulpes*, because the fox, when grown old and during summer, has been observed to be subject to this complaint, has, since the time of Sauvages, been used as the generic term of the disease; but, by the Greeks and Celsus, it was originally confined to one of its species.*

Syn. Fluxus Capillorum, Areæ (*Celsus*); Tyria (*Arab.*); Athrica, Depilatio, Defluvium Pilorum, Pelada, Pilarella (*Auct. Var.*); Pelade (*Parée*); Alopecia (*Sauvages*); Calvities (*Teutonicé*); der Kahlkopf, (*Plenck*); Trichosis Area (*Good*); Gangrena Alopecia (*Young*); Baldness.

The different manner in which the hairs fall, the state of the skin from which they fall, and the healthy or unhealthy state of the hairs themselves, lead to considerable variety of form in the disease. Sometimes the hairs are shed irregularly and indiscriminately, producing only a general thinness of the hair; to this Celsus applied the descriptive term, *fluxus capillorum*.† Sometimes parts of the body are entirely deprived of their hairs, presenting smooth shining patches perfectly bald; these are the areæ of Celsus, (Lib. vi. cap. 4.) the alopecia *areata* of Sauvages, the porrigo *decalvans* of Willan. When the spots of baldness observed no particular form, although usually they are nearly circular, they were denoted by Celsus, after the Greeks, ἀλώπεκια;‡ but when they presented a lengthened serpentine form, generally commencing on each side of the occiput, and sometimes continued until they united in front, the term ὀφίασις was applied to them.§ Sometimes this disease is universal, leaving not a single hair upon any part of the body; (*Well's* Tr. Soc. Med. and Chi. Kn. ii. 264.) in which case it was called, by the French, *la pelade;* although some will have it that, with the falling of the hair, a desquamation of the cuticle was also meant by this term. Sometimes the baldness is confined to one particular part, most commonly to the hairy scalp, when it formerly received the name of φαλάκρωσις or ὠαδάρωσις; sometimes to the eye-brows, eye-lashes, or other parts of the body. The fall of the hairs may take place more or less rapidly; sometimes in a few days, and even in a shorter period, the body has been known to lose all its hairs; sometimes the change is slow and imperceptible. Sometimes the skin, from which the hairs fall, presents the ordinary appearance—smooth, shining, without redness or alteration; sometimes it is pale, of a dead white colour, and furfuraceous; sometimes it is covered with a scaly scurf like pityriasis, which, when removed, exposes an erythematic appearance; sometimes the skin is natural in sensibility, and sometimes it is affected with itching, or a sense of pricking or pungent acrid heat. Sometimes the hairs, before falling, as well as those which remain, present an unhealthy appearance; at other times no alteration can be perceived in them, and those which surround the bald spots are as strong and healthy as natural. Nor are these distinctions trivial or of little help; for they are all connected with particular causes and particular conditions of the body, and, therefore, lead to precision of treatment.

The immediate cause of the falling of the hairs is unquestionably a diseased state of the follicles which nourish and support their bulbs, having the same relation to them as the capsule or membrane which surrounds the roots of the teeth, (for the process of the formation of the teeth and the hair is perfectly the same); but the precise nature of the diseased state has not been determined. It would seem to depend sometimes upon inflammation of the follicles, sometimes upon their ulceration, sometimes upon a temporary deficient action, and sometimes upon atrophy or death of the follicles. In the body of a man who had become almost entirely bald in consequence of a putrid fever, of which he died, Bichat observed all the pilous follicles in their natural state, and small hairs shooting forwards from their bottom; but he remarks that, before the fall of the hair in aged people, the cavity of the bulbs of the hairs gradually diminishes, and the follicles, which contain the bulbs, at last disappear. The destruction of the pilous follicles may, however, be caused by pressure, by friction, and by other causes. Thus it has been observed to be produced by the pressure of certain subcutaneous tumours.

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* De Medicina, lib. vi. cap. 4. *Aetius*, Tetrab. 2, Sermo 2, 55. *Piso*, de cogn. et curand morbis, lib. i. cap. 1 *Oribas*. de loc. affect. cur. lib. iv. cap. 42. *Paul.* lib. iii. cap. 1. *Serapion*. lib. i. cap. 1. *Mercurialis*, lib. i. cap. 4; lib. vi. cap. 4.

† Loc. Citat. lib. vi. cap. 1. *Trallian*. i. 2. *Actuar.* M. M. ii. 5; iv 9. *Oribas*. iv. 5. *Fernel*. Consul. i. 1.

‡ Id. loc. citat. *Galen*. de Cur. Morb. sec. loc. lib. i. cap. 2.

§ *Celsus*, loc. citat. *Oribas*. de Loc. Affect. Cur. iv. 42; viii. 23, 24. *Actuarius*, M. M. v. 13.

Alopecia may be a purely *local* and *idiopathic* disease; the affection originating in the follicles themselves. This happens when it arises from external causes, as from the application of quick lime or other depilatories; from the fumes of quicksilver, as was observed by Forestus in goldsmiths; from exposure of the head to the rays of the sun; from frequent pressure of weights upon the head; and from friction of any hairy surface by the garments or otherwise. Or it may be *local* and *consecutive*, as when the follicles are injured by becoming involved in the inflammation, ulceration, or other morbid process of any adjacent cutaneous disease, as happens in porrigo, impetigo, variola, eczema, elephantiasis, and several others.

Alopecia may also be *secondary* and *symptomatic*, a consequence of general debility and constitutional exhaustion; and hence it attends the convalescence of febrile diseases, and the puerperal state; hence, also, it is a common symptom of the advanced stage of phthisis, of diabetes, and of most cachectic diseases; thus justifying the prudence of the Romans, who estimated slaves affected with alopecia at the lowest price. Hence it is also observed in the nervous debility which follows excessive venereal indulgences or seminal emissions, and has been known to be produced by painful and distressing headachs; by long continued and intense study; by the depressing passions, as fear; by cares, disappointments, and anxiety. Of this kind was evidently that singular case related by Ravator, of a person, who, after a violent commotion, was attacked with amaurosis of the right eye, and all the hairs of the same side of whose body lost their colour, and fell from the eye-brows and eye-lashes as well as from the head. Of the same nature, also, was, in all probability, the remarkable case of M. le Chevalier d'Epernay, (Gazette François, Feb. 23, 1763.) who, after an assiduous application for the space of four months, without any previous symptom of disease, lost his beard, his eye-lashes, his eye-brows, and, in short, all the hair of his head and body.

Alopecia may be a *sympathetic* affection, not a symptom of a constitutional disease, but caused by a disease or disordered state of some other organ or system of organs. The most common form of this description which has come under our observation, is that which proceeds from chronic inflammation of the mucous membrane of the stomach, giving rise to a particular form of dyspepsia, which has, for this reason, been called *inflammatory*. Of this nature, probably, was that mentioned by Galen, (De Cur. Morb. Sec. Loc. lib. i. cap. 2.) arising from eating poisonous mushrooms; and that other noticed by Hippocrates, (De Internis Affectibus, sect. 4.) in which the reader will readily recognize a well-marked case of the above-named form of dyspepsia (*gastrite chronique*), and to which case there is, in an excellent record of modern medicine, (*Journal des Progrés*, 1830. tom. ii. p. 43.) a parallel in form as well as in cause, and which, it is deserving of attention, was afterwards succeeded by an attack of diabetes mellitus. Of the same nature also was in all probability that species of alopecia termed by the Arabians (*Avenzoar*, *Avicenna*,) *bilious*, in contradistinction to the other species which they called *phlegmatic*; which last, in all appearance, corresponded with that form described by Celsus as most difficult of cure, "pejus est quod densam cutem et subpinguem ex toto glabrum facit," coinciding with the observation of some modern writers, that if the skin is pale or insensible, and it is difficult by friction to produce redness, the case is irremediable. Of the same nature is the case given by Lemery, of a man, who, some months after excessive catharsis, lost successively all the hairs from his body; and also another strikingly singular case, which, both in its causes and its cure, justifies the opinion which we have ventured to give of the nature of this species of alopecia. It is so illustrative that no apology is required for relating it. "Lodovico Gnemmi, a Piedmontese, fifty-seven years of age, a person of great vivacity of temper, of a plethoric habit, but spare form of body, having the skin of a dull white colour, began, in the winter of 1825 and 1826, to feel severe pains in the head, with a sensation of burning heat over all the body, but most particularly in the skin: it was to such a degree, that, during the coldest night of winter, he was obliged to throw off his bedclothes. After having passed fifteen days in this painful state, he began by degrees to lose all the hairs of his head, then those of the beard, eye-brows, eye-lashes; and in the course of a month, there was not to be found a hair upon the surface of his body, neither in the arm-pits, on the breast, on the genital organs surrounding the anus, nor upon any of his extremities. All his skin was as smooth as polished marble, and the slightest trace of hairs could not be felt by the hand. He remained for two years in this state, so deformed by the loss of his hair that he hardly ventured to show himself in public, but always feeling on the surface of his body a sense of pungent acrid heat, more especially on the surface of the scalp, which was always morbidly sensible and painful to the touch. In the beginning of March, 1828, he was attacked with a severe peripneumony, which was treated and cured by the most active antiphlogistic remedies, viz.: low diet, general and local blood-letting, cupping, purgation, blisters, &c., and, strange to say, under the influence of this treatment, on the decline of so severe an inflammatory disease, and in a state of the greatest weakness of the circulation, the hairs which had disappeared for the space of two years, began again to shoot forth, and continued to do so during all his convalescence. On their first appearance they resembled fine soft wool, almost colourless wool; but they continued every day to approach nearer to their natural character, which they had fully recovered at the end of a month, when, owing to some imprudence in regimen, he was seized with an acute attack of gastro-enteritis, which carried him off." (Journal des Progrés, tom. xiv. p. 244.)

Of the same nature, also, are many cases of partial alopecia (porrigo *decalvans*) which we have observed in adults as well as in children, and which we have had the satisfaction of remedying by treating the primary disease—chronic gastritis, or inflammatory dyspepsia.

This origin of alopecia also accounts for the connexion which we have observed between it, lichen, urticaria, and pityriasis; sometimes co-existing; sometimes succeeding each other; all differently modified operations of the same cause.

To this description of alopecia ought probably to be also referred those which have been attributed *to the* use of certain kinds of food, and which have been said to prevail at particular places. Thus it is said not to be unfrequent in countries where the inhabitants live chiefly on fish; as, for instance, formerly in the Shetland Islands, where baldness from this cause was so common that it was a familiar saying that "there was not a hair between them and heaven." (*Sir R. Sibbald's* Description of Shetland.) Thus Tournefort relates, that in the island of Mycone, one of the Cyclades, the children are either bald, or seldom arrive at the age of twenty without being so. And, though it is difficult to assign the cause, it must be acknowledged that alopecia (porrigo *decalvans*) has appeared to be more common at Brighton than in other places, and that all the cases the writer has observed in this place have afforded symptoms of chronic irritation of the mucous membrane of the stomach.

Besides the causes of alopecia which have been enumerated, in distinguishing its different kinds, there is one which has been observed by Dr. Willan and others, not easily referred to any of them. It is when the disease appears to have originated in the infection of porrigo scutulata; for when this disease has spread through large schools, in some instances, one or two of the children have been affected with alopecia (porrigo *decalvans*). We have purposely avoided placing amongst the causes of alopecia the influence of age, which belongs more to the ordinary course of nature than to a process of disease, as well as another cause which is said to have a wonderful power in modifying the growth of the hair. We allude to the circumstance of eunuchs, when the mutilation takes place in infancy, having no beard, and yet never becoming bald; a change which is more properly considered a deformity than a disease, but showing a singular connexion between the growth of the hair and the development of the genital organs, of which, however, the perfect state of the body affords many proofs.

There is, however, one species of alopecia which, properly speaking, ought to have been arranged amongst the *symptomatic* forms of that disease, but which, on account of its specific nature, has generally been separated from it—alopecia *syphilitica*. The falling of the hairs is one of the most rare of the secondary symptoms of syphilis, so much so that it is seldom met with—not oftener, it has been calculated, than once in fifteen hundred cases. M. Cullerier, of the Hôpital des Venériens at Paris, who was for twenty-five years in the habit of seeing from two to three thousand venereal patients every year, states that, upon the whole number, he had not met with more than three or four cases of universal alopecia, and from fifty to sixty cases of partial alopecia. Nor was it observed amongst the symptoms of that disease upon its first appearance in Europe; for, either unknown or at least unnoticed before, it was not until towards the year 1538 that it attracted the attention of observers—of Rangon, Fallopius, Massa, Brassavola, and Fracastorius. From that period it seems to have gone on increasing to the end of that century or to the beginning of the next, since which time it has been progressively decreasing, and has almost entirely disappeared in temperate climates; but, if we may place confidence in some accounts, it is less rare in warmer regions, as in Egypt, the southern provinces of Italy, and Spain. It is however not entirely unknown amongst us. Cases are to be found in the works of most medical writers; one of the most recent is that of Professor P. Metons. (Clinique Chirurgicale.)

When this form of alopecia first fixed the attention of observers, it was matter of dispute whether it was a consequence of the disease or of its specific remedy; but though it appears, particularly from the cases of Forestus, that alopecia may be produced by mercury, there are not wanting cases to prove that it has followed syphilis when this remedy had never been resorted to; and its cure by mercury is a strong converse proof that, if it ever arises from it, it is only under very peculiar conditions.

The syphilitic alopecia does not in itself present any peculiarity to distinguish it from the other forms of that disease. It is generally preceded or accompanied by a furfuraceous state of the skin, from which vast quantities of small scales are daily thrown off, in the form of bran, and daily reproduced, and the skin underneath is observed to be redder than natural. But the cotemporaneous existence of other symptoms of the venereal disease, and the history of the case, will afford the best data for diagnosis.

It might be inferred, from the great number and the diversity of the remedies which have been used and recommended for the cure of alopecia, that the method of cure was very uncertain, or the forms of the disease very diversified. As the conclusion is usually drawn from these premises, this latter inference is generally overlooked. But if we admitted it, as we ought, it would lead us not always to throw aside the multifarious farrago of our predecessors as so much useless rubbish, but direct us to seek in the varieties of the forms of disease for the reasons of the application of such various remedies; and, in our opinion, by reconciling in this way the diversity of the disease with the diversity of the methods of treatment, we should entertain a better opinion and make a better use of past experience.

Treatment.—From the distinctions of the different forms of alopecia which we have endeavoured to point out, may easily be understood how it may sometimes have been cured by phlebotomy; by local depletion, as leeches, scarifications, and acupuncture; by purgatives, low diet, and other antiphlogistic remedies: how, at other times, simple local means may have succeeded better, as friction, no matter whether with the fat of the mole, the snake, the hedgehog, or the bear; or with warm exciting substances, as camphor, turpentine, naphtha, laudanum, resin; with volatile oils, as those of laurel, rosemary, mace, or cinnamon, or with the distilled water of bees-wax; with acrid substances, as thapria, euphorbium, stavesacre, nasturtium, mustard-seed, garlic, onions, and tincture of tobacco; with irritating applications, as friction with fig-leaves, nettles, tincture of cantharides, and even the application of a blister: how at other times advantage may have heen derived from alkaline ingredients, which explains the use of the laxivia of wood ashes, of burnt cane, of the burnt hair of bears, and of applications containing the bile of different animals, and the ordure of birds, as the ancient remedy of *stercus columbinus:* how at other times such astringent applications as alum, cimolian earth and wine, or green vitriol, the *atramentum sutorium* of Celsus, may have answered better; and how, whatever be the form of the disease, or the nature of the treatment, the frequent shaving of the diseased parts, which has been recommended by all writers, is a remedy always applicable.

When there exist signs of an inflammatory state of the pilous follicles, or erythema of the surrounding skin, leeches may be applied with benefit, and a course of purgative remedies is of great service. But when the disease of the follicles appears to arise from an inflammatory state of the mucous membrane of the stomach, leeches must be applied to the *scrobiculus cordis*, and a regimen of mild bland diet must be insisted upon. In the first case the best local application is any mild demulcent liquid, as decoction of bran, or mallows. But when the skin, from which the hairs fall, indicates a deficient degree of vitality, the parts may be excited by local stimulants. (℞ *olei macis* ʒii. *alcohol*: ʒiv. M.) Pencilling the surface with a solution of nitrate of silver, or rubbing it with a liniment of olive oil, and as much nitric acid as makes it pungent, but not acrid, have been found to answer the same purpose. Of the use of the celebrated oil of Macassar in such cases we have no experience, but the solution of sulphate of copper in alcohol, lately very much recommended by a German physician, has failed in our hands. When the skin is furfuraceous, or the cuticle hard, shining, and impermeable, like parchment, it is of great use to wash it frequently with some alkaline or sulphurous solution (℞ *Liq. ammoniæ acetatis* f.℥ii. *ammoniæ carbonatis* ʒii. *alcohol:* f.ʒss. *aq. fontan:* f.℥iv. *fiat lotio.*) But when either of the foregoing states of the skin is connected with a deranged state of the general health, it is unnecessary to say that this demands the chief attention.

When alopecia acknowledges a syphilitic origin, the specific remedy of that disease must be had recourse to, exhibited in as mild a form as possible. For the direction and means of effecting this, we refer to the treatment of Acne *syphilitica.* The local applications in this form of the disease differ in no respect from those suited to the ordinary species, except that a few grains of corrosive sublimate may sometimes be advantageously combined with them; and frequently shaving the diseased skin is a part of the treatment which cannot be dispensed with.

T. J. Todd.

ALTERATIVES.—This term, although not expressive of a distinct class of medicines, is so frequently employed as to require particular explanation. By an alterative course of treatment is commonly meant the continued exhibition of certain medicinal agents supposed to have the power of altering certain disordered actions, chiefly of a chronic character; and all medicines possessing, or supposed to possess, such a property, no matter to what class in the Materia Medica they may otherwise belong, are occasionally denominated alteratives. Although the term is often used vaguely, the indication with which an alterative medicine is prescribed is of the utmost importance. It might be said, indeed, in general terms, that all remedial means whatever are alterative, but the alteration sought from the use of specific alteratives, or of alteratives in the restricted and ordinary acceptation of the term, is such as is not readily, or at all, to be obtained, by general or local bleeding, by purgatives or diuretics, by tonics, anodynes, or antispasmodics; although the agency of particular medicines belonging to any of these classes is sometimes made subservient to an alterative course of treatment.

Mercury, in all its various forms, is one of the medicines most commonly employed as an alterative; and the great influence it exerts on the whole economy, over all the secretions and excretions, and over the nervous system itself, constitute it an alterative, when prudently given, of a most efficacious kind. Even in certain states of fever, mercury has been employed with success for the restoration of the secretions, and, therefore, it may be said, as an alterative. In chronic inflammation, although here, perhaps, the term alterative may be objected to, small doses of the pilula hydrargyri or of calomel are often considered highly serviceable: no cases are more frequent than these, and in none is the practitioner more in need of some means of checking or altering actions, which, although neither violent nor immediately dangerous, are silently effecting structural changes and irreparable mischief. It would certainly appear that, for this purpose, the majority of practitioners rely on the efficacy of mercury, often in combination with opium. In certain instances, of which chronic laryingitis may be cited as an example, as well as in the instances of new formations, even of a malignant character, the addition of a medicine possessing narcotic properties may be useful on the principle of allaying the disturbance of the nervous system, a disturbance but little regarded or acknowledged in such cases, but probably intimately connected with the primary functional disorder in which all morbid changes of structure, and even inflammation itself, must commence. Most persons of experience in medicine have met with examples of chronic disorders of a troublesome rather than of a dangerous nature, which have been ameliorated, or entirely relieved, by the persevering use of some of the forms of mercury; although the medicine may have been given at first without any other reason than that it afforded a chance of benefit. Even irritable states of the bronchial and intestinal mucous membrane certainly sometimes give way under this treatment; but the application of it requires that caution of which nothing but observation can teach the value. The advantage obtained in such cases, and in others not unfrequently met with, from the apparently indiscriminate employment of calomel, may eventually be found to depend upon some general law, which has not yet been explained; or simply, as we believe John Hunter thought, one kind of irritation superseding another, and banishing it from the system. No medicine is so commonly given in disease of the mesenteric glands as calomel; it is by no means rarely administered in scrofula; notwithstanding the general opinion of the unfavourable influence of mercury on the scrofulous constitution; and notwithstanding the common accompaniment with mesenteric disease of a state of intestinal irritation or of chronic inflammation. In almost every varied disturbance of the liver, mercury is one of the first medicines to which many practitioners have recourse, and in the form of the pilula hydrargyri it has been recommended in many disorders of the digestive functions. A practice so common must have been supported by many cases in which it was found useful, although the principle on which the medicine acts, if it be not that of suspending morbid actions, is, in some of the cases, not very easily imagined. In the case in which acute inflammation of membranous parts is checked by the employment of calomel; or depositions, the consequences of such inflammation, are removed, of which iritis may be mentioned as presenting a striking illustration; this medicine is given to produce a precise effect, which experience has shown to arise from its use. In the chronic forms of indigestion, its operation on the secretions seems to explain the great advantage often arising from it. In the other cases, cases of mere irritation, or cases in which there is a disposition to new formations not ascribable to inflammation, the same medicine is given, often with the same good effects; but the actions which are then interrupted being less understood, the medicine is only called an alterative.

Antimony is very often employed in the class of cases just spoken of, although not in them exclusively, as an alterative; generally in combination with calomel. The benefit of this combination is usually ascribed to an alterative effect produced by them in the secretions into the intestines, and in the cutaneous exhalation; in other words, in the functions of the bowels and the skin. The pulvis antimonialis is, perhaps, most frequently used with this indication in extemporaneous prescription; and a very useful preparation, the antimonii sulphuretum præcipitatum, is conveniently united in the pilula hydrargyri sub-muriatis composita, with calomel. In this, the celebrated Dr. Plummer's pill, we meet with another alterative in the guaiacum, which, as well as the sassafras, the mezereon, and sarsaparilla, although not so extensively useful, is certainly of singular utility in some chronic affections. Daily observation shows the obvious effects of the Plummer's pill on the bowels and on the skin: the most observable of the immediate effects of the sassafras and the sarsaparilla are produced on the skin, although some effect may occasionally be observed equally early on the intestinal and renal secretions. The taraxacum is a medicine not unfrequently given in chronic affections of the stomach or the liver; and its sensible, as distinct from its alterative action, appears to be greatest on the urinary secretion. In the alkalis we have another description of medicines, often prescribed as alteratives, particularly to scrofulous patients affected with disease of the glands of the neck or of the mesentery, or with diseases of the joints. The carbonates of soda and potass, and sometimes the liquor potassæ or the liquor calcis in combination with sarsaparilla, or with some of the bitters, are prescribed in such cases, and probably produce their good effects by first acting on the stomach itself. But there can be no doubt that all these medicines have an ultimate effect which in reality entitles them to the name of alteratives. This effect, which may be simply expressed by the phrase of altering morbid actions, may be secondary to their action on the stomach, or on the skin, or on both these surfaces; or it may be primary. Accurate observations on the states of the blood in disease are too infrequent to enable us to speak with confidence of the alterative effects of medicines on that important fluid. It is, however, highly probable that the effects of some at least of the alteratives are secondarily, and of others primarily produced on the blood itself. In many of the diseases in which they are most employed, and most useful, there is an evident impairment of secretion. Secretion, although partly dependent on certain nervous actions, demands, for its perfect performance, a healthy state of the blood, the fluid in which and out of which all the various constituents of the various secretions are created. Supposing that from some disorder in the blood, we have produced, certain varieties of disease on the surface, or in the stomach or intestines, or in the bones, ligaments, cartilages, or other solids of the body,—the effect of a medicine which removes such diseases must be to alter that first morbid condition of the blood; and thus to cause healthy secretion and excretion, instead of cutaneous disease, or chronic indigestion, or venereal nodes in the tibia, or increased vascularity and depositions affecting the motions of the joints, or any other morbid action or formation for the prevention or cure of which we prescribe alterative medicines. Such, then, generally speaking, must be the action of alteratives. They may amend the state of the blood by previously improving the functions of digestion and assimilation; or they may directly affect the process of sanguification, a process yet imperfectly understood; but that alteratives do actually change and improve the state of the blood in many instances cannot be doubted. We find in such facts, admitting them to be so, an explanation of the term *depuration*, *attenuation*, *&c.*, used by the older writers, and also of the more popular expressions of "sweetening" and of "clearing" the blood; and in these terms we have a proof how long such an opinion has appeared reasonable to pathologists, and how supported the opinion is by common belief, founded upon common observation.

But supposing the nervous action which has been spoken of, as essential to the proper performance of secretion, to be disordered in cases in which alterative medicines are commonly considered to be indicated,—it may still be understood how this functional office of the nervous system may also be more efficiently performed when an alterative medicine has corrected the disordered state of the intestinal canal; and there are not wanting facts of a nature to incline us to ascribe the influence of some medicines employed as alteratives, to their direct operation on the nerves. Whether the use of hemlock in the case of some tumours, and the effects of the prussic acid in certain examples of phthisis pulmonalis, may not be of this kind, is at least worthy of some consideration. That the addition of a small quantity of the extractum hyoscyami, or of the pulvis ipecacuanhæ compositus, to alterative doses of the pilula hydrargyri, in certain forms of dyspepsia, is serviceable in this way, seems hardly to admit of doubt.

Physicians of great authority, among whom may be mentioned Dr. Heberden, have laid it down as a rule to be observed in the management of obstinate chronic disease, that we should with all care regulate the different functions of the body, diligently observing any departure from their common and healthy condition; and thus place the constitution as nearly as we can in that state in which its own efforts may be put forth for the cure of such persevering and otherwise intractable maladies. It may at least be said, that this is often all that the practitioner has it in his power to do; and it might sometimes be advantageous to the practitioner, as well as to the patient, if the former would limit his ambition by recollecting this. If the obscurity in which internal changes are effected, weakens the evidence in many medical cases, the annals of surgery abound with instructive proofs of the extraordinary local benefit arising from this kind of treatment. This is that constitutional treatment, in fact, which Mr. Abernethy succeeded in introducing into surgical practice; and although the disciples of that distinguished pathologist, and even he himself, may sometimes have carried the principle too far, its foundation is not weakened either by their erroneous zeal or by his eccentricity.

Another rule, less scientific, and less safe, and emanating from authority less to be depended upon, is, when a disease does not readily yield to common treatment, to make some great impression on the constitution, in the hope that, in the general commotion and agitation, disordered actions may be rudely interrupted, or the actions of health felicitously restored. Without entering into any discussion concerning the propriety of the rule, which might perhaps admit of justification even as leading merely to the introduction of a new irritation, its principle is unquestionably alterative. Various means have been employed to produce the desired effect,—a large bleeding, a large dose of mercury, a powerful opiate, or repeated and large doses of metallic tonics. All of these, and other measures adopted with the same intention, have, we doubt not, been occasionally serviceable. Of the advantageous operation of some of them we have been witnesses; particularly of the use of a large dose of mercury in very obstinate sciatica, and of opium in some old and unmanageable cases of epilepsy.

There are certain auxiliaries to medical treatment, which are frequently used with all the indications which have been specified as pointing to the employment of alteratives. Thus, change of air, sea-bathing, alterations of habitual clothing, and sudden or considerable changes in diet, are frequently recommended, and with the best effects; sometimes producing benefit by acting on the stomach or on the skin; sometimes by acting more directly on the blood, or on the nervous system; sometimes by improving the state of the secretions or excretions; sometimes by removing some obstacle to the proper performance of some particular function; and sometimes by producing a new and strong impression on the body or the mind. Many of these advantages are simultaneously obtained by taking the various mineral waters. Change of place, and temporary change of habits, freedom from business, and the gentle excitement of novel forms of amusement, doubtless very powerfully conspire to produce the singular improvement of health so often observed in patients resorting to Cheltenham, Leamington, Tunbridge, Malvern, Harrogate, and other celebrated watering-places; although still a part, and often a very considerable part of the improvement is evidently to be ascribed to the daily and moderate excitement of the stomach and bowels, and, in some cases, of the kidneys, by the ingredients of the mineral water itself, which thus acts as a most valuable alterative of the whole system. That the external application of the waters stimulates the skin to new action, and thus produces direct relief, and, in this way, or by sympathy, improves the tone of the stomach, or effects more extensive improvement, must also, we presume, be admitted.

The class of chalybeates contains agents which have an evident effect on the circulation, as tonics. Given, however, in the minute state of subdivision in which they are held in solution in natural springs, they produce effects which entitle them to the name of alteratives. They excite the circulation, which was before languid, and, in all probability, they alter and improve the condition of the blood. Either directly, or through their first action on the sanguiferous system, or by some direct or indirect influence on the actions of the nervous system itself, or in more than one of these ways at once, they stimulate the secretions, which were before scanty and imperfect; and they more manifestly alter the state and appearance of the body than any other medicines whatever. In conditions of the body suited to their use, no alteratives are, in fact, so effectual. They substitute general energy for general debility, and revive the colouring of health in patients before pallid, or wan, or discoloured, as in the chlorotic, by long disease. The illustration of an alterative by reference to remedies of this class, shows, however, the impossibility of effectually dividing alteratives from other classes of medicines.

When medicines are intended to act as alteratives, they are usually given in small doses, repeated every night for some weeks; such, at least, is the general mode of prescribing alterative doses of calomel and the antimonial powder. From two to five grains of either are frequently prescribed in this way, to adults, but most commonly the smaller dose of both. Five grains of the Plummer's pill contain rather more than one grain of calomel and of the precipitated sulphuret of antimony, and two parts of guaiacum. In many cases of disordered digestion, small doses of the pilula hydrargyri (gr. ii. or iii.) are given every night or every other night, or still smaller doses twice or thrice a day. None of these medicines can properly be employed without interruption for more than a few weeks: if their good effects are not perceived in that time, a perseverance in their use will hardly ensure them; their use may, however, be suspended for a week or a fortnight, and then advantageously resumed. The young practitioner should, however, very carefully endeavour to distinguish those cases in which an alterative plan of treatment affords any prospect of amendment, from those in which the loss of time in its ineffectual trial will prove injurious. The mind is prone to any belief which favours indolence; and there are practitioners who content themselves with the delusion that no treatment, except the alterative treatment, is really efficacious in any chronic case.

Another error, not very uncommon, is the protracted employment of medicines of this sort. Their effects, not being suddenly produced, are sometimes overlooked; or being brought about very gradually, and long expected in vain, they are at length watched for with less diligence, and disregarded when they might be discerned. The complete discontinuance of an alterative is of course best indicated by the desired improvement taking place in any case. When such medicines are properly applied, (and no medicine is useful but by timely application,) indications of their general effects, and even of their mode of action, may clearly be perceived. The tongue, for instance, loses its morbid coating; the appetite improves; the bowels become more regular; the skin grows smoother or freer from eruptions; the mind becomes more cheerful; the patient sleeps better; and the countenance becomes expressive of that feeling of general comfort which is incompatible with chronic disease, and arises from the due and healthy performance of all the bodily functions. Unless some of these effects result from the use of alterative medicines, after a reasonable continuance, the practitioner should carefully inquire into the cause of such failure. He will probably find it in some local disorder, not to be removed without local treatment, and which he ought to have recognised at an earlier period. On the other hand, when the signs of amendment which have been mentioned appear, it should be recollected that to persevere in the use of alteratives is to apply to the body, in a state of health, actual causes of disease. It would seem superfluous to notice such plain and obvious particulars, if observation did not show us that, from the neglect of such plain and obvious things, rather than of things less on the surface, mistakes are daily committed.

With respect to the guaiacum, which has been enumerated among the alteratives, and which has a very ancient reputation, it is not easy to ascertain its precise share in the good effect produced by the compound calomel pill. Except in that formula, its application is nearly limited to certain cases of chronic rheumatism, in which, we fear, it must yet be allowed that Dr. Ferriar's observation concerning it is correct; and that, whilst there certainly are some forms of the disorder in which its effects are excellent, it very frequently seems to have no effect at all. The tinctura guaiaci ammoniata, in doses of one or two drachms, is the most common form in which this medicine has been employed in rheumatic cases. We have ourselves little to say of its efficacy when used alone; and we so often remark, when doubt has been once cast on the operation of a medicine, and the effect is carefully looked for, that it fails to be observed, as much to wish that not only the guaiacum, but many or most of the articles in the Materia Medica were submitted to new and careful clinical experiments. No part of medicine is in more need of complete reform than that which relates to the actual effect of medicines daily and hourly employed.

The sassafras, like the guaiacum, is not often prescribed as an alterative by itself; it enters, with the mezereon, into the composition of the compound decoction of sarsaparilla, a medicine of great value in a very large class of cases. This decoction seems, in English practice, to have superseded the once famous Lisbon diet-drink, of which sarsaparilla and the sulphuret of antimony were among the principal ingredients. This is not one of the alteratives of which the good effects are to be expected from small doses. Indeed there is reason to think that disappointment has sometimes arisen from the decoction of sarsaparilla having been given in too small a quantity. In ordinary cases, the patient is required to take a pint of the compound or of the simple decoction daily; and three or five grains of the Plummer's pill, or three grains of the pilula hydrargyri, or five grains of the hydrargyrum cum creta, or a few grains of calomel and antimony, are commonly prescribed to be taken at night during the use of it. But if it is desired to ensure the full effect of the decoction of sarsaparilla, and particularly if its operation is solely trusted to, the patient should be persuaded to drink two, three, or four pints a-day, and sometimes even a greater quantity.

An alterative plan of treatment generally comprehends the use of some of the medicines spoken of in this article. Others are occasionally employed with the same intention, but it is unnecessary to dwell upon them, for it will be seen that the line of division is, after all, rather artificial than real. Whatever medicines may be employed with this indication, it should be remembered that the proper regulation of the patient's diet, and strict attention to all the articles of regimen, are indispensable auxiliaries; the effects to be expected from this kind of care being indeed obviously analogous to those of alteratives.

[For *alteratives*, a term—as often used—conveying no distinct meaning, Dr. Dunglison has substituted *eutrophics*, promoters of healthy nutrition. See EUTROPHICS.] J. CONOLLY.

AMAUROSIS, from ἀμαυρόω, to obscure. This is the name applied to one of the diseases of the eye, in which defective vision depends on impaired sensibility of the retina. The term *gutta serena* has also been applied to this disease, from an erroneous notion that the dark enlarged pupil, which sometimes accompanies it, is a drop of black fluid which interrupts the passage of light. In practice, when a patient without opaque cornea, closed pupil, or cataract, complains of lost or defective vision, he is considered to suffer from this disease.

Viewing the exquisitely delicate organization of the retina, and the origin, course, and complicated connexions of the optic nerve, it is not surprising that impaired vision should so frequently be produced by disease in some part of the nervous apparatus. The ultimate fibres of the optic nerve, expanded into a membrane of extreme tenuity, supported and disposed upon a membrane of nearly equal delicacy, from whence it derives its vascularity, and covered and separated from the neighbouring choroid by a tunic of still greater delicacy, present altogether a piece of anatomical organization most likely to have its functions impaired by slight deviations from the natural or sound condition. Disorganization of the hyaloid membrane, upon which this delicate structure rests, or of the choroid, with which it is externally in contact, may also materially affect its condition. The optic nerve, with its vascular and membranous accompaniments, enclosed in a sheath of fibrous membrane in its course through the orbit, pierced by the central artery, and closely connected with other arteries and nerves, is exposed to many injurious deviations from the natural structure. The same optic nerve within the head, from the vicinity of large vessels, and its complicated nervous connexions at the place of decussation, the tuber cinereum, the crura cerebri, the thalami, and the tubercula quadrigemina, is liable to suffer from disorganization of its own structure, as well as of any of those parts with which it is connected. A review of the structure of the nerve of vision, from its origin at the tubercula quadrigemina to its anterior termination at the ciliary processes, is the best preliminary exercise for one about to study the disease of amaurosis.

Injury or disease of the brain, as ruptured vessels, serous effusion, softening, tumor, or abscess, frequently impair the functions of the optic nerve, although such injury or disease should exist in a situation remote from the origin or course of the nerve. Amaurosis may, therefore, be a consequence of cerebral disease, although the optic nerve should be sound from its origin to its termination. [Lawrence *on Diseases of the Eye*, Amer. edit. p. 478: Philad., 1843.]

Injury or disease of a nerve, or morbid condition or irritation of particular organs, affect injuriously the brain and nervous system, and thus impair the functions of the retina: hence amaurosis from gastric, hepatic, or uterine disturbance. The experiments of Magendie, inconclusive as they are, and often proving too much for the hypothesis they are intended to strengthen, at least show that the fifth pair of nerves exerts some very important influence on the function of vision; pathological observations on this subject, although few in number as yet, lead to the same conclusion, and the effects of injury of the frontal nerve in producing amaurosis, long since observed, establishes the fact. Ptosis, depending on disease of the third pair of nerves, is always accompanied by defective vision.

Arterial and venous vascularity is an essential part of the organization of the retina, as it is of the whole nervous system; the existence of large vessels carrying red blood in a structure of such delicacy and transparency is even a remarkable circumstance, when contrasted with the apparently bloodless condition of many other white or transparent structures. Increased arterial action, or obstructed venous circulation, may, therefore, materially affect the condition of the retina, and impair its sensibility.

There is great variety in the perfection of vision in different individuals; which may be attributed partly to a difference in sensibility of the retina, but in a still greater degree to a difference in power of adaptation of the eye to distance. It appears a great mistake to suppose that this difference in perfection of vision depends altogether on the power of adaptation. A difference in perfection of vision is often observed in persons who appear to enjoy an equally perfect power of adaptation. A single lens remedies, in a great degree, the defect arising from want of power of adaptation; but no single lens will confer on a landsman the distant vision of a sailor, nor on a long-sighted person the power of distinguishing minute objects enjoyed by some near-sighted persons. It is scarcely reasonable to suppose that any alteration in curvature or relative positions of the cornea, or lens, in birds, can take place sufficient to account for the great superiority in vision which these animals enjoy. The sight of nocturnal animals, and of persons who can see perfectly in obscurity, can only be attributed to a superior sensibility of the retina, as it is altogether independent of any superior power of adaptation.

The sensibility of the retina is increased by two totally different causes,—permanent exposure to a strong glare of reflected light, or a long-continued residence in a darkened apartment. The inhabitants of snowy countries are obliged to adopt the precaution of protecting the eyes by means of a goggle, with a slit opposite the pupil, and the inhabitants of towns in which the buildings are white are said to suffer from inflammatory affections of the eyes. Persons immured in dungeons are said to acquire a power of distinguishing even small objects in their obscure abodes, in which, at first, they could not detect even a glimmering of light. The morbid sensibility of the eye to light, in what is called scrofulous ophthalmia, is in a great degree to be attributed to the injudicious exclusion of light from the eye by the use of shades, or confinement in a darkened room. The effect of light and shade upon the sensibility of the sound retina is beautifully exemplified by the simple experiment of directing the eye to some opaque object intervening between the observer and the light. If the eye be fixed for a few minutes upon the sash of a window, upon turning it in a different direction, a luminous image of the opaque sash remains. In this case the glare of light poured in through the glass on the unshaded part of the retina renders it less sensible, while the part shaded by the opaque sash retains its original sensibility; all the retina is afterwards exposed to the same quantity of light, yet to that part which was shaded it is a glare, while the part previously exposed to a stronger light has its sensibility blunted. If this explanation be correct, it is at variance with the fact previously stated, that exposure to the glare of reflected light, from snow or whitened buildings, raises the sensibility of the retina. The sensibility, however, produced by exposure in snowy countries appears to be morbid and permanent, probably connected with slight inflammatory action. That inflammation of the eye is accompanied, in many cases, by morbid sensibility of the retina, is confirmed by daily observation; and we have cases on record of persons being enabled to read, even in the darkness of night, in consequence of accidental injury producing inflammation. Amaurotic patients, suffering from inflammation, often observe an improvement in vision while the inflammation continues, which ceases as it subsides.

These and many other facts and reasonings, which might be brought forward, prove that the retina in its most healthy and natural state is endowed with different degrees of sensibility under different circumstances, and, therefore, there cannot be any difficulty in admitting that morbid changes, however slight, may materially alter its functions. The facts stated, also, show that an acquaintance with the structure and functions of the retina must be the foundation of our knowledge respecting the disease under discussion.

The discussion of the causes of amaurosis involves so many details, and presents so many apparent contradictions, that some arrangement of the materials becomes absolutely necessary. A primary division into organic and functional has been suggested, and has been insisted upon by Mr. Travers in particular. This has been objected to, and justly, on the ground that, although we have abundant evidence of the occurrence of the organic disease, yet, that it remains to be proved whether there is any disease purely functional, any disease which does not depend on structural or organic alteration, however temporary. For practical purposes we believe the distinction to be good. Daily observation proves that the functions of organs become instantaneously suspended, and as suddenly restored; and this has repeatedly occurred in the case of the retina.

By those writers who do not attempt any arrangement of this intricate subject, or who adopt an imperfect one, amaurosis is attributed to numberless causes apparently directly opposite in nature: to inflammatory action and vascular turgescence from general plethora, or to debility from hemorrhage: to menorrhagia or to amenorrhœa: to suppressed perspiration, healing of large ulcers or issues, sudden suppression of the secretion of milk, or to discharge from piles, nursing, diarrhœa, diabetes, ptyalism, or venereal indulgence: to the removal of cutaneous eruptions, or to the occurrence of gastric or intestinal irritation, exanthematous diseases, dentition, or worms: to pregnancy, or to total suspension or abolition of the uterine functions: to exposure to strong light, or to confinement in darkness: to drunkenness, narcotic poisons, direct rays of a hot sun, muscular efforts, grief, joy, fear, rage: to wounds or irritation of nerves of the orbit, especially of the ophthalmic branch of the fifth pair; to neuralgia, tooth-ach, or to total paralysis of those nerves: to hydrocephalus, hydrothorax, hereditary predisposition, hysteria, typhus fever: to metastasis of various diseases, as gout, rheumatism, and many others.

If the primary division into organic and functional be good, it should afford us some clue to this labyrinth. The division, organic amaurosis, must obviously include those varieties of the disease which depend on alteration in structure of the retina or of the optic nerve to its origin, embracing inflammation of the retina and its consequences, increased vascularity, thickening, or other alterations in texture, the organic disease by some described under the title glaucoma, fungus, hæmatodes, and hydrophthalmia. To this division must also be referred those cases depending on wasting, tumour, or other disorganization of the optic nerve, pressure from exostosis, aneurism, or other tumour. The functional form of the disease necessarily includes those cases which depend on affections of the brain without actual diseased condition of the optic nerves, derangements of the vascular system, irritations of the gastric or intestinal mucous surfaces, disturbed uterine functions, mental emotions, and general debility. Hence amaurosis from hemorrhage, plethora, venous turgescence, menorrhagia, amenorrhœa, diarrhœa, worms, dentition, hysteria, venereal indulgence, suppressed cutaneous eruptions, nursing, and suppressed secretion of milk. Diseases of the brain present difficulties in the adaptation of this arrangement. Effusion of blood or serum, tumour or softening, may cause amaurosis, either by the effect on the sensorium generally, in which case the disease might be considered functional; or by actual pressure or destruction of the optic nerve in some place from its origin to its exit, in which case it is to be considered organic.

If the example of some writers be followed, who consider amaurosis, from whatever causes it may arise, as presenting a certain uniformity of character, every symptom which has ever been found to occur in any form of the disease, must be enumerated as the symptom of that uniform disease. But it is obvious, that, although a certain train of common symptoms present themselves in every form of the disease, amaurosis from peculiar causes must afford peculiar symptoms. The symptoms common to the disease in all its varieties, must first be enumerated, and those peculiar to each particular form detailed as such particular form comes under consideration.

Imperfection or loss of vision is, of course, the essential and prominent symptom of this disease; that is, the principal complaint of the patient, and the cause of his visiting the practitioner. The imperfection of vision varies both in degree and form. The student complains that he can no longer read with comfort, the letters become confused, indistinct, and run into each other; the mechanic complains that he can no longer follow his employment; the watchmaker can no longer detect minute flaws in his work; the carpenter cannot make a correct joint; the smith no longer distinguishes the thread of a fine screw or the head of a rivet; and workers with the needle and at the loom become completely disabled from following their employments. The next prominent symptom is the appearance of motes, films, gauze, cloud, or coils, intervening between the observer and the object, technically called muscæ volitantes. These appearances are thus described, by Mr. Travers, from personal experience: "The *musca volitans* is sometimes solitary, following the eye at a fixed angle as it passes along a line; sometimes two, three, or more, are presented; more frequently an immense assemblage, descending in a cloud as the eye is raised, and ascending as it is depressed. They are obvious to so many analogies, and apprehension of impending blindness makes patients so minute in their observation and description of them, that it is scarcely possible to do justice to our experience in attempting to describe them. Sometimes they are represented as globular, sometimes angular and flat, like a piece of money. Portions of flue, of soot, insects' wings, transparent vesicles, or minute globules of quicksilver, connected like the links of a chain, or short hairs with their bulbs attached to them, are ordinary resemblances. They occupy the air with some persons, and are seen upon looking at the sky, or upon a white sheet of paper, and especially in shifting the eye from one object to another; to some they appear in the fire or candle only, and with others they seem to cover the ground, so that they walk in them knee-deep." [These appearances may likewise be present when there is no serious affection of the eye. They are dependent upon some modification in the blood-vessels of the retina, which may never interfere farther with vision. (Dunglison's *Human Physiology*, 5th ed., i. 220: Philad.: 1844.)] The next symptom of amaurosis is different in its nature from the last: the retina appears to be insensible in some of its parts, while the rest retains the natural sensibility to light. In such case the patient complains of double vision, or interrupted vision, as if portions of objects were deficient, as letters or syllables in words when reading; or of half vision, when one-half of an object is seen distinctly and the other half is totally invisible; or objects are seen only when placed in a particular position, requiring some attention on the part of the patient to place the object in such a position as will direct its image to the sensible part of the retina. Ocular spectra constitute another symptom of amaurosis; in this case the images of luminous objects remain on the retina after the object has been removed, or the eye turned from it; as when the patient looks at the sun, a candle, or a patch of any bright colour, on turning the eyes away or even closing them, an image of those objects still presents itself, but of a different colour. The symptoms complained of by an amaurotic patient are thus summed up by Mr. Lawrence, in his published lectures: "The symptoms of amaurosis are such as are derived from the altered state of the function of the part, and under this head you may have every kind of impaired vision; every kind of defect in the perception of objects as to form, colour, and their relations to each other: the patient who has amaurosis generally complains of weakness or dimness of sight; he cannot employ the eye so long as he used to do; the letters of a book begin to run into each other; or other evidences of imperfect sight are noticed. In this early and incipient stage of the affection, where sight is only partially imperfect, it has been called *amblyopia amaurotica*, amaurotic weakness of sight. The various defects of sight (*vitia visûs*), enumerated as distinct diseases in nosological catalogues, are only to be considered as amaurotic symptoms, forms of the impaired function. Of these may be mentioned, *visus nebulosus*, *visus interruptus*, *visus dimidiatus*, *visus muscarum*, or *myodesopia*. Floating bodies appearing before the eye have been called *muscæ volitantes*, and when only a single black speck is seen, it is called *scotoma*. It is not uncommon for a patient to see a black speck in the centre of an object; and as the affection proceeds, the opacity increases in size, becoming larger and larger, until it covers the field of vision. When these objects increase in number, they form before the eye a sort of gauze or network, and that state of vision has been called *visus reticulatus*. Sometimes objects appear brighter than is natural, and that is called *visus lucidus*, or *photopsia*, and occasionally that brightness is so considerable as to produce uneasiness to the patient, which is then named photophobia. Isolated objects are seen occasionally double, and hence the name sometimes given to amaurosis of *visus duplicatus*; this, however, is generally the result of strabismus. There is also a *visus coloratus* and a *visus defiguratus*, from objects being seen of wrong shape and colours. In particular instances, the eye affected with amaurosis becomes near-sighted or far-sighted, or, as it is termed, myopic or presbyopic; a presbyopic state of the eye is the most common attendant on amaurosis; it is less frequent for the eye to become myopic in this affection. It is very common for patients to be able to see objects laterally after they have lost the power of seeing them in the direct line of vision."

The symptoms above enumerated are denominated, by Mr. Mackenzie, the *subjective* symptoms, while he applies the term *objective* to those now to be noticed; in other words, we learn from the patient the defects he experiences, and from observation those which are visible to others. The state of the pupil, the action of the muscles of the eye, the attitude or expression of the patient, are of the latter description. The changes in organization obvious to the eye must be distinctly considered when amaurosis from this cause is discussed.

The size of the pupil, and the degree of activity in the motions of the iris, often afford valuable information as to the extent of disease, but, perhaps, not to be so far relied upon as is generally supposed. The motions of the iris, even if correctly understood, are still the subject of dispute; and the complicated distribution and connexion of its nerves is not satisfactorily settled: it is, therefore, not surprising that the state of the pupil in amaurosis should often be unintelligible. It cannot be denied that, in the majority of cases, defective vision from impaired sensibility of the retina is accompanied by a sluggish or inactive state of the pupil; and that, therefore, the state of the pupil must always be considered a valuable guide toward a correct knowledge of the cause and extent of the disease. In the commencement of the disease, the pupil dilates and contracts *sluggishly*; as the disease increases, the pupil becomes more *dilated* and fixed; and in complete blindness it is fully and permanently dilated, constituting the true *gutta serena*. From this general rule, however, the practitioner finds many exceptions. Complete blindness is not necessarily accompanied by completely dilated pupil or *gutta serena;* on the contrary, perhaps there are more cases of complete blindness with contracted or half-dilated pupils than with perfect dilatation. It is also to be remembered that complete and permanent dilatation of the *pupil* is not necessarily accompanied by loss of vision: the application of belladonna proves *that it is* not; and cases of fully dilated pupils *without* blindness are occasionally met with. *Amaurosis*, both complete and partial, is sometimes found to be accompanied by active and perfect contraction and dilatation of the pupil. This is not the place to attempt an explanation of these apparent anomalies; the subject is one of the greatest difficulty, and involves so many considerations foreign to the present article, that the student must be satisfied with the facts alone.

The motions of the eye-ball and lids, and the general aspect, gesture, and bearing of the patient, often afford valuable information to the practitioner. Most writers have described the vacant expression of countenance which is often observed in persons completely blind from amaurosis. In such case the patient approaches with a moping stare and gesture of apprehension, as if completely bewildered. This is, however, often accompanied by other symptoms of paralysis, and is, perhaps, to be observed in those cases only which depend on cerebral disease. The gesture of the patient blind from cataract is different, because vision is not entirely gone; he approaches in an attitude as if endeavouring to see something through the thick cloud which is interposed between him and objects. The motions of the eye-ball are often highly characteristic. The eye is either fixed, with very little mobility, or it turns irregularly in every direction, with a trembling oscillating motion. This occurs most frequently in bad cases of long standing.

Squint is another symptom often observed in amaurosis. This may arise from the effort of the patient to bring a more sensible portion of the retina into the position in which it may receive the impression of the image of the object; or it may arise from a diseased condition of the third or of the sixth pair of nerves. In the disease technically called *ptosis*, all the muscles supplied from the third pair of nerves are paralysed, and squint is produced by the action of the external straight muscle, which is supplied from the sixth pair. Squint is also unquestionably produced by paralysis of the external straight muscle from disease affecting the sixth nerve.

[The method of examining the eye, termed the "catoptric," which consists in holding a candle before the eye, the pupil of which has been previously dilated by belladonna, and noting the images of the candle, affords valuable information, where any difficulty exists, as is at times the case, whether the disease be amaurosis or cataract. When the humours are unimpaired, and the affection is wholly in the nerve of vision, three images of the candle are seen; two erect, and one inverted; the former reflected respectively from the cornea and the anterior layer of the crystalline; the latter from the concave surface of the crystalline; whilst in cataract the erect, or the inverted image, or both, will be dull, indistinct, or absent, owing to opacity of the anterior or of the posterior portion the crystalline, or of both.]

The origin, causes, and symptoms of amaurosis having been discussed in a general way, the disease is now to be considered circumstantially in detail as it depends on distinct and obvious causes. The most frequent cause of amaurosis of the worst form is internal inflammation of the eye and its consequences. This is, therefore, the first to be considered.

1. AMAUROSIS FROM INFLAMMATION OF THE RETINA, AND ITS CONSEQUENCES.

That amaurosis, or, to speak more plainly, defective vision, must attend inflammation of the retina is obvious; it is, in fact, the symptom, not the disease: and, therefore, the subject of inflammation of the retina must receive distinct consideration. The first question to be settled is, whether inflammation of the retina ever exists perfectly insulated, and without involving the neighbouring structures; or whether inflammation of the other parts of the globe of the eye, as the iris or choroid, ever occurs without involving the retina. This is a question of some difficulty. The functions of the retina are so frequently impaired from iritis, both during the existence of inflammation and after it subsides, that the extension of the inflammation from one to the other, or their co-existence in both, must be admitted; and, therefore, the general adoption of the term iritis, and its frequent application to inflammation of all the contents of the eye-ball, have proved most injurious, by directing the attention of the practitioner to the state of the iris exclusively, and placing out of view the retina, which, from its greater delicacy, and from its integrity being so much more essential to vision, should be an object of greater anxiety. It is not denied that iritis does occur without corresponding inflammation of the retina; but it is certain that they are both frequently engaged, and that the disease, in such cases, is general inflammation of the eye-ball, or internal ophthalmia.

Mr. Travers says, in his Synopsis of Diseases of the Eye, page 137, that "the retina is sometimes, though rarely, the seat of inflammation; but it is an error to suppose that intolerance of light is a sign of this affection, as is clearly proved in the strumous ophthalmia, in which, though the intolerance is in excess, the retina is uninjured: and, secondly, because the effect of inflammation upon a nerve of sense is to produce palsy, not increased excitability." That intolerance of light is not necessarily a symptom of inflamed retina may be admitted; but it is not proved that the effect of inflammation is to produce palsy of a nerve of sense.

The causes of inflammation of the retina are as various as those of general inflammation of the eye-ball. The disease may arise from gout, rheumatism, syphilis, mercury, or typhus fever; or it may be idiopathic, without assignable cause. Mr. Lawrence appears to consider every form of amaurosis to arise from inflammation. He says, "Amaurosis, in its most frequent and important form, that which is seated in the eye itself, is generally inflammation of the nervous structure; including, under that phrase, all degrees of increased vascular activity, whether designated as fulness, turgescence, determination, congestion, or as inflammation in its most limited sense; and the usual result of inflammatory disturbance, that is, organic change, permanently destroying the function of the part."

Mr. Travers describes the symptoms of inflammation of the retina as follows: "the first and predominant symptom of inflamed retina, viz. a sudden attack of vehement dashing pain of the most distracting kind, which is described to extend from the bottom of the eye-ball to the occiput, or in the reverse direction, and the supervention within a few hours of total blindness, with occasional sparks and flashes of vivid light." "The pupil, upon inspection, is gaping and motionless, as in confirmed amaurosis, and the humours are thick and muddy." Mr. Wardrop observes, that, "When the retina is affected with inflammation, the disease is marked by painful vision; intolerance of light; sparks of fire, or drops of a red colour falling before the eyes; little external redness; pain darting through the head; with more or less constitutional derangement." To suppose that inflammation of the retina is always accompanied by those violent symptoms would be dangerous in practice. The disease is often mild and insidious in its approaches, and marked more by defective vision than by symptoms of inflammation. The first care of a practitioner, on approaching a person complaining of defective vision of recent occurrence, is, to ascertain whether there be any evidence of the existence of inflammatory action in the retina. The symptoms may often fail to satisfy him; there may be no pain, no morbid sensibility to light, no headach. The state of the pupil is no guide, as it is affected, more or less, in almost every form of amaurosis. The form or nature of the *spectra*, or *muscæ volitantes*, does not enable him to pronounce with certainty. The difficulty is, however, frequently removed by careful inspection of the state of the sclerotic coat. The arterial inflammatory vascularity of the sclerotic has always afforded a characteristic symptom of internal inflammation of the eye-ball, and has been dwelt upon with emphasis by Mr. Saunders, and subsequent writers. The red vessels converging toward the anterior part of the eye-ball, in distinct lines, and forming by their delicate subdivision into minute branches a bright red zone round the circumference of the cornea, is always pointed out to the student as an appearance indicative of internal inflammation, and a uniform accompaniment of iritis. This appearance often, perhaps always, in a greater or less degree, accompanies inflammation of the retina; and when attended by defective vision and complaint of a film or gauze before the eye, should probably be considered conclusive evidence of the nature of the disease.

The treatment of inflammation of the retina must embrace the means usually adopted to remove or restrain inflammatory action, modified and proportioned to the nature, peculiarity, and intensity of the disease in each individual case. Such are, general bleeding, leeching, and cupping, nauseating and purgative medicines, mercury, and blisters. When the attack is accompanied by the intense and alarming symptoms just now enumerated, on the authority of Mr. Travers, the adoption of a vigorous plan of depletion is obviously demanded, and general and local bleeding indicated; recollecting, however, that we should not be too sanguine as to the result, or place too much confidence in these resources, unassisted by other means. Daily experience proves how unavailing mere depletion is found in irritis, or general internal inflammation, and even how unsuited to particular cases, however intense the symptoms. The value of mercury in the treatment of internal inflammation of the eye in general, and of inflammation of the iris in particular, is now so fully appreciated, that no argument need be employed to induce the practitioner to give it a fair consideration. Mr. Travers makes the following observations respecting its administration: "When the amaurosis is recent and sudden, and either the signs of an obscure inflammation are present, or only the amplitude and inactivity of the pupil correspond to the patient's history, the indication is less simple; mercury should be introduced with all convenient rapidity into the system, I mean so as to ruffle in the least possible degree. No adtage is obtained by salivation; on the contrary, I think it hurtful. When mercury is beneficial, its efficacy is perceived as soon as the mouth is sore. I have seen it tried, and have myself tried it in many cases of amaurosis, without the smallest advantage; but in cases of recent occurrence, imperfect, but rapidly progressive from bad to worse, I have been witness to its power in suddenly arresting the disease in too many instances not to entertain a far higher opinion of it than of any other article of the Materia Medica." Mr. Lawrence, who, we have already said, appears to consider the majority of cases of amaurosis to arise from inflammatory action, sums up the treatment as follows: "Our object is to put a stop to vascular excitement, to prevent the permanent injury of altered structure, and impaired function in a structure the peculiar delicacy of which particularly exposes it to such danger. We must, therefore, employ antiphlogistic treatment of a decided character, and follow it up with a decision and steadiness commensurate with the importance of the affected organ: under the head of antiphlogistic treatment, must be included general and local blood-letting, but more particularly the latter, as, by cupping from the back of the neck or the temples, or by the application of leeches, the evacuation of the bowels by purgatives, and a restricted diet. Repose of the organ should be observed, more or less complete, according to the nature of the case; counter-irritation by blisters, from which a discharge may be kept up by irritating dressing: these are the means suitable to the early stage of the affection, the stage of excitement; but if this treatment be not found to remove the change which has been produced in the retina, we must have recourse to mercury, which appears to be as decidedly beneficial in these cases, as in iritis, or general internal inflammation. The remark which I made respecting the use of mercury in those affections, applies also to the present case, namely, that its good effect mainly depends on the promptitude with which it is employed. The alterative form is insufficient; we give it with the view of arresting inflammation in the structure, which is the very seat of vision: that structure is easily changed by the inflammatory process; our only remedy is to push the mercury in a decided manner; and, if we do so, we shall put a stop to the affection. We have used mercury very freely for amaurosis; we have used it until profuse salivation has been produced, and many decided instances of the good effect of this practice have come under our observation."

The practitioner has other resources than those above mentioned. Internal inflammation of the eye yields often to remedies of very different character; and inflammation of the retina forms part of that disease. Cases may occur where general depletion is inadmissible. Old and debilitated females, scrofulous subjects, persons already weakened by disease, poverty, or confinement in ill-ventilated apartments, or who have, perhaps, just gone through a mercurial course, evidently would not derive relief from such treatment: on the contrary, they would require a tonic plan of treatment, with the free administration of bark and generous diet. If inflammation of the iris be arrested or restrained by the administration of turpentine, as stated by Mr. Hugh Carmichael, and it seems agreed that in certain cases, probably of peculiar character, it is a valuable remedy, it should constitute one of the resources in inflamed retina. Should the inflammation occur in a gouty or rheumatic habit, or alternate with affections of the joints, or other symptoms of these diseases, the treatment must be modified accordingly, and advantage taken of the resources which medicine affords in such cases. Colchicum, under such circumstances, has been resorted to with some advantage. The eye should be protected from the irritation of strong light; but total darkness is unnecessary, and is probably pernicious, by increasing the sensibility of the retina. Care should be taken that, in excluding light, the free circulation of fresh air round the patient should not be interrupted. No circumstance has contributed more to the want of success in cases of this description, than confinement of the patient to the respiration of an atmosphere contaminated by human effluvia.

2. AMAUROSIS FROM DISORGANIZATION OF THE RETINA, A CONSEQUENCE OF INFLAMMATION.

It is reasonable to believe, that during the inflammation of the retina, vision is impaired by those changes which uniformly accompany inflammation, as increased vascularity, and excited or altered sensibility; while the effects or consequences, such as enlargement of vessels, and thickening or disorganization of structure, remain after inflammatory action has subsided. These two states present as remarkable a difference in character as the acutely inflamed conjunctiva, and the vascular and altered condition heretofore denominated the chronic stage of that disease. In practice this distinction must never be lost sight of, because the treatment of an inflamed retina must be very different from that of a retina which has formerly suffered from inflammation. The practitioner, therefore, has first to ascertain whether the case before him be actual existing inflammation of the retina, or disorganization produced by inflammation.

Cases of amaurosis from disorganization of the retina are of frequent occurrence, because this state of the eye is produced by every form of internal inflammation. The patient complains of defective vision, under all circumstances: he can read with difficulty, for he can only distinguish the larger letters; he sees the general outline of objects, or the more remarkable appearances in form or colour, but he cannot distinguish the features of those near him, or recognise his acquaintances. A film or mote of precise unvarying form appears to float before the eye, and frequently a uniform cloud or mist interrupts vision. A lighted candle appears as if seen through a mist, or is surrounded by a halo. These are a few of the symptoms of which the patient complains: many others of the same description are occasionally observed.

On looking into the eye in such cases, the pupil may appear perfectly transparent; the iris may be capable of acting, though sluggishly; and the cornea and sclerotic may be in an apparently healthy state. On a closer inspection, a slight irregularity of the pupil may be observed, which becomes more remarkable upon shading the eye from the light, and still more upon dilating the pupil with belladonna, when an adhesion of the margin of the pupil to the capsule of the lens at one or two points becomes visible.

Where this little brown string of adhesion is attached to the capsule, a slight opacity of that part may be observed. This is the slightest degree of actual change of structure to be observed in those cases; in other examples the disorganization is much more obvious. If the eye has suffered from severe internal inflammation, the entire margin of the contracted pupil adheres; causing a circle of white opacity at the place of adhesion, and leaving a central portion of the capsule and lens transparent, and capable of transmitting the rays of light to the retina. If the previous inflammation has been still more destructive in its consequences, the pupil is much contracted, or even completely closed, and adhering to the capsule of the lens, which is opaque; constituting capsular and, probably, lenticular cataract. The existence of the cataract does not alter the case as regards the retina; it is still, partially or wholly, insensible to light, as is often proved by the want of success in operations for cataract in such cases; and this very state of the eye should make the operator cautious in his prognosis as to the result of an operation, as in such cases the cataract may be removed, and yet no vision follow, on account of the disorganization of the retina. The sclerotic coat frequently presents, in such cases, a livid vascularity, with large veins ramifying through it in every direction; and in the worst cases the shape of the globe is altered, and the sclerotic is projected or stretched into a staphylomatous tumour, or depressed into hollows by the action of the muscles. This state of eye-ball is highly characteristic of the completely unsound retina, and proves the hopeless nature of the disease.

In considering the treatment of amaurosis, or impaired vision, the consequence of internal inflammation, the first question to be determined is, whether the treatment adopted in the inflammatory stage be applicable to this: recollecting that the state of the eye now under consideration is a consequence observed many months, or even years, after the cause has subsided. The doubts respecting the state of the retina, and the treatment of its diseases, arise from the impossibility of seeing the alterations in its structure. Opacities of the cornea, and enlarged vessels of the conjunctiva, are visible after the inflammatory stage of purulent ophthalmia has passed away; and the practitioner is, therefore, satisfied that he cannot remove them by a repetition of the depletion which he first adopted. If the thickness and vascularity, which probably exist in the retina, were equally visible, he would also despair of removing them by his first plan of treatment. Abstraction of blood may be advantageous in full plethoric habits, to relieve a turgid state of vessels already permanently enlarged; but it should not be resorted to with the view of removing inflammatory action, which no longer exists. Mercury is frequently administered in these cases, and apparently because it has been found advantageous in the inflammatory stage. If mercury be of any use in such cases, it is by promoting absorption of lymph, or other deposit found during inflammation; it is not, however, found to effect such objects in cases where deposits, or thickenings, are obvious to the eye, as in opacities of the cornea, or in closed pupil, and, therefore, probably possesses no such power here. At all events, mercury should not be indiscriminately resorted to, and a guarded prognosis of the result of its administration should be made. To rouse the activity of the impaired function, or to raise the sensibility blunted by disorganization, impressions on the extremities of the fifth pair of nerves may be advantageously resorted to; hence the practice of repeated blistering all round the orbit, or of applying stimulating liniments, or sinapisms, in the same situation. With the same view, sternutatories may assist; and perhaps, in certain cases, electricity.

3. Amaurosis from vascular turgescence, not amounting to inflammation.

Amaurosis is sometimes caused by hemorrhage, as well as by a general plethoric state of the vascular system; but it is difficult to determine why this happens in some cases only. Hemorrhage occurs every day, and yet blindness from this cause is rare. Amaurosis is not by any means a constant, perhaps not a frequent symptom of general plethora, or that state termed a determination of blood to the head. Whatever may be the condition of the arterial capillaries of the retina when the action of the heart is suspended, interrupted, or greatly weakened, blindness is not a necessary consequence; it does not occur in bleeding, unless faintness be produced; it does not attend extreme weakness, with imperceptible pulse, preceding death; nor is it a consequence of the application of a ligature on the carotid, which restrains hemorrhage or cures aneurism. On the other hand, whatever may be the state of the venous capillaries of the retina, during a turgid or obstructed state of the venous circulation, blindness is not found to be a consequence of temporary pressure of the jugular veins, or of accumulation of blood in the right side of the heart, from disease of the heart or lungs. These considerations are important in a practical point of view; upon them the practitioner founds his estimation of the degree of value of a system of depletion, or the opposite plan of invigorating or increasing the activity of the vascular system.

The first care of the practitioner in cases of defective vision, without apparent inflammation or disorganization of the retina, is to ascertain, as far as symptoms admit, whether there be reason to suspect increased arterial or obstructed venous vascularity. The amaurotic symptoms afford no satisfactory evidence upon the subject. The information must be derived from the appearance of the patient, or the existence of undue vascular action elsewhere, turgidity of the vessels on the surface, especially those visible in the conjunctiva or sclerotic, throbbing of the arteries of the head, or fulness of the jugular veins. Mr. Mackenzie, in his Treatise on the Diseases of the Eye, says, "It has been mentioned that plethoric persons are in general able to produce a degree of congestive amaurosis at will, by stooping, tying their neckcloth tight, and the like. We also frequently witness a temporary amaurosis from exhaustion. For instance, if the nervous system is the seat of no particular excitement at the time, we observe that by the sudden abstraction of blood, the organs of vision, and, indeed, all the organs of sense, are strikingly enfeebled. In some individuals the debility continues for several days, and if any one of the organs of sense has been previously weaker than the rest, the feebleness of that organ is generally increased by bloodletting. When syncope is produced by loss of blood, sight appears to be the sense which fails first, and which recovers last. Hearing is next, while smell, taste, and touch, are less affected, and more easily re-animated by excitation. They return in a very short time to their natural state; but it is not so with sight. It is a popular opinion that bloodletting weakens the sight, and, to a certain length, the opinion is founded in fact." This view may be contrasted with that in the preceding paragraphs; but whatever doubt may be entertained respecting the effect of particular states of the vascular system on vision, there can be none in practice as to the propriety of removing, if possible, a turgid state of the vessels, in persons suffering from amaurosis.

If, therefore, a person complains of defective vision, with those symptoms which indicate vascular turgescence, the cause of this turgescence must, if possible, be ascertained. If the countenance is bloated and purple, and the conjunctiva full of large veins, and there are difficult respiration and other symptoms of disease of the heart or lungs, the cause is obvious. Such cases are of daily occurrence, and in the indications of treatment the removal of that cause must not be overlooked; or, if it cannot be removed, the prognosis must be regulated accordingly. But if no such existing disease be obvious, and yet defective vision with symptoms of vascular turgescence be present, that symptom must be combated by the usual means; as bloodletting local and general; blisters or sinapisms behind the ears as counter-irritants, or a seton in the neck, as a permanent discharge; sponging the forehead and head with cold water, using the shower-bath. The bowels should of course be emptied, and all future accumulation there prevented, and the functions of the stomach and liver preserved in a state of perfection. Abstemious diet, exercise in the open air, alterations in habits, and every other plan calculated to improve the general health, should of course be enjoined. In the application of this plan of treatment, the following observations of Mr. Travers deserve attention: "A loss of balance in the sanguiferous system, occasioning an undue determination of blood to the head, often exists distinct from general plethora, and is aggravated by loss of blood. Cases of undue determination of blood to the organ are especially common after deep-seated chronic inflammation, or distress from over excitement, by which vessels have lost their tone; an effect decidedly increased by depletion."

4. AMAUROSIS FROM INTERRUPTION OF THE FUNCTIONS OF THE DIGESTIVE ORGANS.

Whatever doubts may be entertained respecting the efficacy of the treatment of amaurosis by emetics and purgatives, it appears to be agreed on all hands that defective vision is often a consequence of interruption of the functions of the digestive organs. That amaurosis is, however, every day attributed to this morbid condition where there is no evidence of the existence of any such cause, is known to every practitioner; but it is equally notorious that it is frequently a symptom of dyspepsia, and its occurrence from worms or other irritating matters in the alimentary canal is a still more decisive proof of the effect of such causes. It must not be forgotten, that in the majority of these cases the individual is exposed to those remote causes which may lead to the interruption of the functions of the retina as well as those of the alimentary canal. The sufferers are generally artisans or students, whose gastric organs may be injured by their sedentary habits, mental exertions, or confinement in close and unhealthy apartments; while vision may at the same time be impaired by the application of the eye to minute or brilliant objects. For practical purposes, it is only necessary to determine whether a patient complaining of impaired vision, and muscæ volitantes, with sluggishly acting or fixed pupil, foul tongue, headach, flatulence or acidity of the stomach, and torpid bowels, should be treated for his dyspeptic symptoms, or only for the amaurosis; and, on the other hand, whether a patient complaining of impaired vision, muscæ volitantes or spectra, and presenting a fixed or inactive pupil, without any apparent symptom of gastric disease, should be treated with medicine calculated to remove dyspepsia. Whatever doubt may be entertained respecting the propriety of the administration of emetics and purgatives in amaurosis, where the state of the digestive organs does not indicate it, there cannot reasonably be any in directing the attention to this object where defective vision is accompanied by gastric derangement.

Schmucker and Richter in Germany, and Scarpa in Italy, have been the most decided advocates for the emetic practice; and in this country it has been followed up with various degrees of success: upon the whole, however, the testimony of writers is unfavourable to the practice, at least unless indicated by symptoms of gastric or biliary derangement. The following is the plan adopted by Scarpa: "The first part of the treatment of imperfect amaurosis is restricted to emetics and internal resolvents. It is desirable in the majority of cases, if the patient is an adult, to prescribe three grains of tartar emetic dissolved in four ounces of water, of which he should take two spoonfulls every half hour until nausea and abundant vomiting be produced. The day after, he should take the resolvent powders, composed of an ounce of cream of tartar, and a grain of tartar emetic, divided into six equal parts. The patient should take one in the morning, another four hours after, and a third in the evening, for eight or ten days in succession. This remedy will cause some nausea, and produce some more frequent discharge of the bowels, and perhaps some vomiting. If during the employment of these resolvent powders the patient makes ineffectual efforts to vomit, if there is a bitter taste in the mouth with loss of appetite, without any improvement in vision, the emetic should be repeated; and this for three or four times, if the presence of gastric irritation, bitter taste in the mouth, tension of the hypochondria, acid eructations, and tendency to vomit demand it. When the stomach is cleared out, the resolvent powders of Schmucker should be prescribed, consisting of the following ingredients: *Gum. sagapen., Galban. Sap. venet. aa.* ʒi; *Rhei.* ʒiss; *Antim. et Potass. Tart.* gr. xvi. *Ext. glycyrr.* ʒi; *Ft. pil. gran. unius.* Fifteen of those pills to be taken night and morning for four or six weeks; or the formula of Richter, consisting of the following ingredients, may be preferred: *Ammoniac. Assafœtid. Sap. Venet. Valerianæ rad. Summit. arnicæ aa.* ʒii; *Antim. et Potass. Tart.* gr. xviii. *ft. pil.* gr. 2. Fifteen to be taken three times a day for some weeks." It is scarcely necessary to observe that the farrago composing these resolvent pills can possess no peculiar virtue, and that modern improvements place more valuable remedies and resources in the hands of the practitioner. Nor need we repeat here the plans of treatment to be adopted for the removal of the diseased condition of the stomach or alimentary canal. The educated practitioner must suit his treatment to the peculiarities of each particular case; keeping in view the necessity of removing all offending matters from the stomach and bowels, avoiding all food or drink calculated to aggravate the disease, and altering as far as possible the habits of the patient.

It is desirable to record the opinions of practical writers respecting the treatment just alluded to. Mr. Travers, p. 304, says, "I do not recollect an instance of decided benefit from the emetic practice, although, in respect to its high authority, I have tried it fairly in many instances. The cases of gastric disorder to which it is especially applicable, are most benefited by a long course of blue pill, with gentle saline purgatives and tonic bitters. In most of those cases we must depend, first, on the regulation of the visceral functions; and, secondly, on the employment of such restoratives as the system requires and can bear. The blue pill, with colocynth, rhubarb, or aloes, and the combination of soda with rhubarb and colombo or gentian, are best adapted to the former purpose. The exhibition of general tonics is often strongly indicated, and I have seen much benefit derived from the mineral acids, bark, steel, (when admissible,) and arsenic, after a due regulation of the digestive functions. I know of no article of the class of stimulants that has any direct claim to notice, or any approach to a specific virtue, such as has been ascribed to the arnica montana, aconite, &c." Mr. Lawrence, who, as has been already observed, considers the majority of cases of amaurosis to depend on inflammatory action, or vascular turgescence, observes, "When the antiphlogistic treatment and a fair trial of mercury have failed, I do not know that it is possible to effect any further essential good by other means. We must be contented with such management and simple diet as are most conducive to general health, and take the chance of such local amendment as the affected organ may slowly experience under gradual general improvement. Residence in a pure air, frequent exercise out of doors, a plain, mild, but nutritious diet, the regular use of mild aperients, with the occasional employment of a more active purgative, and repose of the affected organ, form a combination of measures best calculated to invigorate the system generally, and thus, as far as circumstances will admit, to arrest local disease. The effects of counter-irritation may be advantageously tried in conjunction with such measures. Blisters may be applied behind the ears, and at the side or back of the neck, and a discharge may be kept up by the savin cerate. But we prefer a succession of blisters, applying a new one to a fresh surface every five, six, or seven days."

[The endermic use of strychnia has been advised by Mr. Middlemore, (*Treatise on Diseases of the Eye*, p. 290,) and by Messrs. Liston, Henderson, Fornari, Pétrequin and others; but Mr. Tyrrel and Mr. Lawrence, (*On Diseases of the Eye*, Amer. edit., p. 519,) have never seen it or veratria exert any power over the disease. It has been used, also, internally, and in the form of collyrium, containing from two to eight grains to two ounces of water; a little acetic acid being added to render the strychnia more soluble; and two drops being let fall into the eye a few times a day. (Dunglison's *New Remedies*, 4th edition, p. 554, Philadelphia, 1843.)

Besides blisters, acupuncture, moxas, ammoniated lotions, and every form of revellent, have been used to the temples, behind the ears, or to the back of the neck. Some cases of imperfect amaurosis have likewise been treated with success by galvano-puncture; and similar results have been obtained from the use of a galvanic current, made to pass from the mastoid process to the superciliary ridge, (*Op. cit.*, p. 40 and p. 327.)]

5. AMAUROSIS FROM EXERCISE OF THE EYE ON MINUTE OBJECTS.

It cannot be denied that defective vision is occasionally produced by exposure to this cause; but when it is recollected that thousands, nay millions, are thus exposed, in a greater or less degree, some doubt may be permitted as to its operation, especially when sufferers in this way are exposed to other causes which affect the health generally. Students, scriveners, printers, engravers, microscopic observers, watchmakers, gilders, furnace-workers, and cooks, are enumerated among the sufferers from this cause. But there are sedentary or unhealthy employments calculated to impair the functions of many organs, and in this way alone to produce that state of the retina which accompanies the disease. Simply using the eyes constantly in intently viewing minute objects, although such objects should not reflect any unusual quantity of light, appears to impair vision as much as working on brilliant objects; at least we find as many cases of impaired vision among tailors, scriveners, shoe-makers, and cabinet-makers, as among engravers, gilders, glass-blowers, or cooks. The question which it is here important to solve, is, what is the state of the retina in these cases? Is it a state of excitement with morbid sensibility and increased vascular action, a state approaching to inflammation? or is it the very reverse, a state of impaired sensibility and defective vitality? Until these questions are solved, impaired vision, from these causes, cannot be positively referred to the division of functional amaurosis more correctly than to the organic. It has already been stated that Mr. Lawrence considers amaurosis of this character to depend upon inflammatory action, or, "vascular activity, whether designated as fulness, turgescence, determination, congestion, or as inflammation in its most limited sense."

The symptoms, in cases of this description, are merely impaired vision, disabling the patient from following the usual pursuits of reading or working; muscæ volitantes, or spectra, of various colours, forms, and qualities, floating before the eyes; and a fixed or sluggishly acting pupil. It does not appear that the symptoms are materially different, whether the disease has arisen from exercise of the eye on brilliant objects, or on objects merely minute.

Whether it may be advisable to rely upon a treatment directed to the improvement of the functions of the digestive organs in amaurosis, from these causes, must be very questionable. The principal reliance must be placed in the removal of the original remote cause. The patient should understand that no remedies can avail while he continues to exercise the eye as before. There can seldom be much difficulty in accomplishing these objects, when the patient does not depend for a livelihood upon the exercise of his eye; but the poor artisan has often only the alternative between starvation and blindness. Under such circumstances, every argument should be used to induce the patient to give up his trade for a summer, and to endeavour to earn his bread by rural occupations. The most careful inquiry and examination must be made to ascertain whether there be any evidence of the existence of inflammatory action or vascular turgescence in the retina. The history and progress of the case, the appearance of the sclerotic and pupil, the constitution and habits of the patient, must be the best guides. The practitioner could not reasonably determine to adopt an antiphlogistic treatment with a sallow, pallid, emaciated patient, whose eyes present no unusual vascularity; while it might be imperiously demanded in a bloated, gross man of intemperate habits, and whose eyes are disfigured by vascularity. If it be necessary to adopt the antiphlogistic plan, it is to be followed up as detailed when speaking of inflammation of the retina, and recourse had to the administration of mercury to the same extent. If the digestive organs are impaired in function, they must be improved by the usual means. If there is no evidence of inflammatory action, but, on the contrary, a languid circulation and general debility, every method calculated to improve the general health must be adopted, as pure air, invigorating diet, and tonic medicines. Blistering and other stimulating applications in the vicinity of the orbit, and pungent applications to the nostrils, and even to the conjunctiva itself, may be found of service.

6. AMAUROSIS FROM INJURY OR DISEASE OF THE FIFTH NERVE, OR ITS BRANCHES.

It has long been known that injury of the frontal nerve, or branch of the ophthalmic branch of the fifth, is injurious to vision, and, consequently, that this nerve exerts some very important influence on this function. Little more than this is now known, notwithstanding the attempts of Magendie to clear up the doubts on the subject by experiments on animals. These experiments, which are detailed in his journal of physiology, are of so violent and destructive a nature, and so much calculated to disturb or destroy the functions of the nervous system generally, that the results stated to have followed cannot be attributed to the mere division of the fifth nerve. It is, however, most probable, since vision is impaired by injury of a branch of the fifth nerve, that it should also be impaired or destroyed by division of its trunk. Pathological observations, hitherto not numerous or authentic, will probably do much more toward elucidating this subject than destructive experiments on living animals. No opportunity should be lost of ascertaining the state of vision previous to death, in persons whose fifth nerve shall be found diseased or destroyed. The nature of the connexion between the fifth nerve and the nerve of vision is illustrated by the fact, that, in cases of conjunctival inflammation, modified by scrofula, violent sneezing is produced by exposure of the eye to light. Disease or growth of a tooth has sometimes been found to impair vision. Such a case is recorded by Dr. Galenzouski, of Wilna, in the *Archives Générales*, where blindness was produced by a splinter of wood becoming entangled in a diseased tooth. Mr. Travers, says, "I have seen an incipient amaurosis distinctly arrested by the extraction of a diseased tooth, when the delay of a similar operation had occasioned gutta serena, on the opposite side, two years before." Defective vision frequently attends neuralgia in the vicinity of the eye. Mr. Travers, says, "There is an intermittent spasmodic pain accompanying some cases of amaurosis, shooting through the orbit into the head, of the most acute and distressing severity; it makes a periodic attack at or about the same hour every night, and continues for several hours; it is accompanied by convulsive quivering of the muscles of the eye and eyelids, and profuse lacrymation; there is nothing in the appearance of the organ to explain its nature and origin. What has been described as an intermitting ophthalmia, is, I think, improperly so termed—the pain, not the inflammation, is intermitting. The pain of tooth-ach, according to the state of the vascular system, is subject to intermissions more or less complete; but the periodic pain to which I refer, is independent of any visible sign of inflammation. I believe it is a *tic douloureux*, affecting one or more of the orbitar branches of the fifth pair of nerves. I have cured it, in two cases, by arsenic, where opium failed to prevent the paroxysm. I have known one instance of a similar affection, without any defect of vision." Mr. Wardrop affords the following information on this subject: "Wounds of the eye-brow, injuring the frontal nerve, have frequently been known to produce amaurosis; the amaurotic symptoms coming on in some cases instantaneously, and sometimes long after the wound has been healed." Morgagni mentions having seen a case of amaurosis produced by a wound above the eye-brow, which, he observes, explains a passage of Hippocrates. "The sight," says the father of medicine, "is obscured in wounds which are inflicted on the eye-brow, or a little higher." This curious fact we have seen illustrated in several instances; and it is an example of the sympathy which exists between parts whose nerves have a direct communication, the ophthalmic branch of the fifth pair sending off the frontal nerve, and also a twig to join the third pair to form the lenticular ganglion. It is only when the frontal nerve is wounded or injured, and not divided, that amaurosis takes place; for, as will hereafter be observed, amaurosis, following a wound of this nerve, may sometimes be cured by making a complete division of the trunk nearest its origin. Portal saw a child, who received a slight puncture on the forehead with the point of a knife, which was followed by a considerable convulsion of the upper lid. This ceased when a small incision was made at the place of the puncture. A gentleman received an oblique cut in the forehead, which, from its direction and depth, must have injured the frontal nerve. The wound was not accompanied by any severe symptoms, and soon healed. But afterwards the vision of this eye began to fail, and in a few months was completely destroyed; the pupil was much dilated, the iris was not influenced by variations of light, and had slight tremulous motions. A sailor got a blow on the edge of the orbit, from a ramrod during an engagement, at the place where the frontal nerve passes on the brow. The vision of that eye was instantly destroyed, and when we saw him several years after the accident, the eye remained amaurotic, with a dilated and immovable pupil: a cataract had formed in the other eye. An officer, at the siege of Badajos, received a deep wound on the eye-brow by a piece of a shell, which, from its direction, must have injured the frontal nerve. Great inflammation and pain succeeded the wound, the vision of the eye became gradually imperfect, and, after a few months, was entirely lost. The pupil was very much dilated and immovable, and the crystalline lens opaque. Wounds of the infraorbitary nerve and *portio dura* are sometimes followed by amaurotic symptoms. Beer mentions an instance of the former; and we witnessed the case of an officer, in whom a ball wounded some branches of the latter nerve, which was followed by amaurosis. This connexion between the branches of the fifth pair of nerves and retina affords a useful channel for applying remedies in diseases of retina. It is not injury of the fifth pair of nerves alone that proves injurious to vision; paralysis of the upper lid, with loss of power of moving the eye-ball, except outward, evidently depending on compression or disease of the third pair, is also attended by defective vision. The writer of this has very recently seen a well-marked case of amaurosis with distinct and undoubted paralysis of the abductor muscle, disabling the patient from turning the eye outward, and obviously depending upon compression or disease of the sixth pair of nerves.

To cure amaurosis from injury of the frontal nerve, or any other branch of the fifth pair, is difficult, and often not to be accomplished. Division of the nerve appears an obvious resource, and has been repeatedly tried, but with little success: which, perhaps, might have been anticipated, when it had been observed that amaurosis had sometimes arisen from simple division, as in the removal of a tumor. Mr. Guthrie, says, "The only hope of relief that we are at present acquainted with, lies in a free incision made down to the bone, in the direction of the original wound; and even of the efficacy of this, I am sorry I cannot offer testimony from my own practice, having failed in every case in which I tried it." Some of these cases recover, or at least improve, by time; a result to be expected, when it is recollected that the numbness from division of a branch of a nerve often disappears. The general health, in such cases, should be attended to; all pressure on the wounded part avoided, and gentle frictions, with a liniment containing belladonna, tried, especially if there be pain.

The occurrence of blindness from injury of a branch of the fifth pair is instructive, because, as Mr. Wardrop observes, it throws light upon a question of importance in the treatment of amaurosis, the efficacy of superficial impressions in rousing the sensibility of an amaurotic retina. Some appear to undervalue, or even discard the use of stimulating applications to the vicinity of the eye in cases of amaurosis, such as blisters, sternutatories, liniments, rubefacients, sinapisms, or pungent applications to the conjunctiva itself: but when we see violent sneezing produced by the impression of light, and recollect the other proofs of connexion of function between the nerves here, we are more than justified in giving trial to such means.

[In some cases, amaurosis has yielded to the extraction of one of the teeth of the upper jaw, of the same side as the affected eye; doubtless through the impression made directly on ramifications of the fifth pair, and indirectly on the retina.]

7. AMAUROSIS FROM INJURY OF THE EYE.

Blindness is generally the consequence of a violent blow on the eye-ball, although none of the visible parts of the organ appear materially injured. What the real extent of the injury in these cases may be, is not certain; but it is very probable that the delicate connexions of the retina with the neighbouring structures are injured or severed; or there may be ecchymosis of its structure, or in the cells of the hyaloid membrane. Vision, in such cases, is greatly impaired, or even totally lost; and the pupil is generally irregular in shape and dilated. If the accident be followed by inflammatory action, the usual appearances of internal inflammation of the eye-ball are added. The prognosis, in these cases, must be very cautious; because the prospect of recovery depends upon the extent of the injury, which cannot be ascertained. If vision begins to improve some hours, or even days, after the accident, which is often the case, further improvement may be anticipated. In such cases it may, perhaps, be suspected, that there has been more of concussion than actual destructive disorganization, and, therefore, gradual recovery may be expected. Even if the improvement in vision be still slower, but progressive, perfect cure will probably follow. But if vision be greatly impaired or destroyed, with irregular and dilated pupil, and without any amendment after some weeks, the worst may be apprehended. When the injury, which is often the case, extends to the iris or lens, and terminates in cataract, other considerations, foreign to the present inquiry, suggest themselves.

The first care of the practitioner, in cases of this description, is to avert or allay inflammation, by cold applications to the eye, local and general bleeding, purgative medicine, and abstemious diet. The inflammation sometimes assumes a chronic character, proceeding to disorganization of the eye, as rheumatic inflammation does, and cannot be arrested by the usual means. Whether, in such cases, recourse should be had to mercury, is a doubtful question; but experience does not encourage the practice. In this chronic state of the disease, blistering is indicated, and may be resorted to with advantage. Under any circumstances, after all inflammation, or danger of inflammation, has subsided, efforts should be made to rouse the sensibility of the retina by external impressions. The means of effecting this object, which are applicable to this case, as well as to every other of loss of sensibility of the retina, without inflammatory action, are, blisters, sternutatories, pungent applications to the conjunctiva, and electricity; all which may be tried without injury, and with some hope of success. The conjunctiva may be conveniently stimulated by the fumes of ammonia, or by the vapour of ether evaporated from the palm of the hand, as suggested by Mr. Ware.

It has already been stated that amaurosis is caused by various diseases or habits, affecting the nervous and vascular systems generally. Such diseases or habits are either debilitating, as hemorrhage and menorrhagia, diarrhœa, venereal indulgence, suckling; or they are calculated to accelerate vascular action, and produce a general plethoric condition, as suppression of accustomed discharges, drunkenness, and gluttony. Metastasis of diseases, as of gout or rheumatism, or the removal of cutaneous eruptions, may often be found a cause of amaurosis. Diseases affecting the optic nerve by pressure, or involving it in some specific disorganization, as aneurism, exostosis, tumours of various kinds, fungus hæmatodes, cancer, and caries of bones of the skull, necessarily produce imperfection or destruction of the functions of the retina. Diseases within the head, as rupture of vessels, ill-balanced circulation, softening, hydrocephalus, enlargement of arteries, and tumours, are some of the most frequent causes of amaurosis. General disturbance of the functions of the nervous system, not depending on disease of the brain, as hysteria, and those affections known under the common term nervous diseases, are often accompanied by amaurotic symptoms. In all these cases the origin of the defective vision is obvious to the practitioner, and the nature of the origin suggests the treatment. The amauroris, in many of them, is merely the symptom, which disappears upon the removal of the remote disease. The history and treatment of amaurosis depending on the causes just now enumerated, are not, therefore, detailed here.

Arthur Jacob.

AMENORRHŒA. Amenorrhœa has been usually divided into retention and suppression of the menses. Under this head we shall also consider vicarious menstruation.

I. Emansio, or retension of the Menses.

The non-appearance of the menstrual discharge at the usual age does not, in itself, constitute a disease. The condition of the bodily developement must chiefly be taken into consideration, for the age at which the ovarian functions are first manifested varies exceedingly. Instances of very precocious puberty are numerous; neither is it at all uncommon to meet with cases where the menstrual discharge does not occur till a very late period of life: but if the general health is not affected, medical interference will be rarely required. Climate has a marked influence over the period of puberty. Whilst in sultry regions sexual maturity will usually take place at the age of eight or ten years, in colder countries it is deferred till eighteen or twenty; and in Lapland, according to Linnæus, women will often menstruate only during the summer months.

[Mr. Roberton (*Edinb. Med. and Surg. Journal*, Oct. 1832, and *Lond. Med. Gazette*, July 21, 1843,) has endeavoured to show, that the age of puberty is as tardy in the colder as in the tropical regions, and that were marriages to take place in England at as juvenile an age as they do in Hindostan, instances of very early fecundity would be as common in England as they are in that country. He is of opinion, that early marriage and early intercourse between the sexes, where found prevailing generally, are to be attributed not to any peculiar precocity, but to moral and political degradation, exhibited in bad laws and customs, the enslavement more or less of the women, ignorance of letters, and impure or debasing systems of religion. He has also shown from statistical evidence, that menstruation does not occur more early in the negress than in the white female. (Dunglison's *Human Physiology*, 5th edit., ii. 348. Philada., 1844.)]

In temperate climates, the usual period of puberty is about fourteen years of age; and when the signs are delayed much beyond that age, or when the sexual developement takes place, but is not followed by the consequent monthly discharge, amenorrhœa may be said to exist in the form we are now describing. The two conditions of body are, however, essentially different. In the former, puberty itself is delayed, whether from idiosyncrasy, from want of constitutional energy, or from defective organization. In the latter, puberty exists; the ovaria and the uterus are organically matured; but their peculiar function is suspended.

In the former condition, we meet with young women of eighteen or twenty years resembling children in conformation, with a weak and languid frame, a feeble circulation, attenuated, colourless, and of stinted growth. The case is obviously one of constitutional debility, and, only as such, requires medical treatment. Should the general powers be renovated by time, or the judicious employment of tonics, a nourishing diet, salubrious air, and well regulated exercise, the menstrual discharge will either take place with other signs of puberty, or the case will become of the description above alluded to, and presently to be noticed. But puberty may also be delayed with another condition of body, where the general health and strength continue unimpaired, the growth proceeds as rapidly as in others, the circulation is active, and the frame vigorous; but there are no protuberant mammæ, no sexual propensities, a slight beard grows on the upper lip, and the general characteristics resemble those of a male. In such a case the probabilities are that the ovaries are either absent, or have become so diseased that their functions are entirely lost. A striking instance is related by Mr. Pott, where a precisely similar state was artificially induced by removal of the ovaries in a young woman in St. Bartholomew's Hospital, although, previously to the operation, menstruation and all the signs of puberty had regularly existed. In such organic defects medicine is of no avail; though, under the possibility of the ovarian functions being interfered with by the pressure of some neighbouring tumour, the use of iodine, potass, mercury, or other medicines to promote absorption, might be advisable.

When, at the usual age of puberty, a decided change in the system is observed, and a struggle is evidently taking place to bring about the sexual functions, although followed by no actual develpement, we may conclude that the defect is only in degree, and that, by proper assistance, nature will accomplish her object. In some cases, the failure may be said to be merely local: the mammæ are enlarged, the pelvis has become capacious, the pudenda covered with hair, puberty is established, but the menstrual discharge does not take place. There are now peculiar symptoms set up; head-ach, with a sensation of fulness and throbbing, a flushed countenance, heaviness, pains in the back and limbs, and a full pulse, generally remarkably slow, though, in some cases, accelerated. There appears to be either a torpor of the uterine vessels, which ought to secrete the menstrual discharge, or (as some have supposed) a spasm of their extremities. The causes of this condition are generally to be found in the previous habits of the patient; for it is most frequently met with in those who have led sedentary and indolent lives, who have indulged in luxurious and gross diet, and been accustomed to hot rooms, soft beds, and too much sleep. The remedies are usually successful, and rapidly so. In the first place, the overloaded circulation is to be relieved by a brisk purgative, abstemious diet, and the abstraction of blood; if the symptoms of plethora are strongly marked, bleeding from the arm in considerable quantity may be required; but, in genèral, the application of leeches to the labia, pubes, groins, or os uteri, or cupping on the loins, will be sufficient. Bleeding from the foot, either by leeches or from a vein, was formerly preferred; and many practitioners of the present day still recommend it, as equally salutary and more palatable to the patient. The purgatives most efficacious in such cases are those which not only unload the vessels, but stimulate the rectum: aloes, colocynth, or senna and the neutral salts, are preferable; and, in addition to these plans, pediluvia, either of simple hot water, or made stimulating by the addition of mustard-flour, may be used for half-an-hour, night and morning. This treatment should be persevered in till the symptoms of plethora disappear, when it may be suspended, and merely a free action of the bowels kept up by the daily use of an aloetic purgative, either till the menstrual discharge comes on, or till, at the end of about a month, the congestive symptoms again are perceived, to be again similarly treated. Exercise, especially on horseback, will materially assist in promoting the desired effect, and, of course, all the old habits of self-indulgence are to be entirely broken through. Should these plans fail, we must have recourse to those remedial agents which have been supposed more particularly to have the property of exciting uterine torpor, and which we shall notice in considering the next description of cases.

In these, as puberty approaches, there is a marked derangement of the general health, from the powers being unequal to the impending struggle. The patient has been, perhaps, growing rapidly, and has perceptibly become much emaciated; the face and lips are pallid; the hands and feet cold, particularly the latter; there is great lassitude, and the least exertion produces fatigue; the tongue is foul, the bowels are costive, the appetite is defective and irregular, the pulse slow and feeble. A more aggravated set of symptoms gradually supervenes; the complexion becomes peculiarly sallow, often of a greenish tint; and hence the name frequently given to this stage of the disease, *green sickness*, or chlorosis: (see Chlorosis.) Every part of the system partakes of the general torpor; the circulation becomes still more languid; and the blood seems, as it were, to stagnate in the veins. The digestion is nearly gone, the tongue covered with a dirty coat, and indented, at the edges, by the teeth; the breath is fetid, and there are frequent acid or offensive eructations, with air rumbling in the bowels, which are generally obstinately confined; and when they are acted upon by medicine, the motions are dark and foul. The appetite is irregular and capricious; so that the most indigestible substances are often craved and devoured with greediness; chalk, slate-pencils, sealing-wax, tallow, and dirt; for it is by no means true that the longing is always for articles which nature points out as salutary, as, for instance, anti-acids and absorbents. The spirits are weak and depressed; hysterical tears are easily excited; the girl prefers a moping solitude; and decided melancholy, with delusions, will occasionally be manifested. The absorbents partake of the general debility; and there will be puffiness of the face after sleep, and anasarcous extremities in the evening. Palpitation of the heart will be frequently troublesome, and there will be dyspnœa on the slightest exertion; and along with this latter symptom, a short distressing cough. Hence it is that there is no disease more frequently mistaken for phthisis, and the error is a most serious one; for much injury would be occasioned by the remedies generally administered for the latter complaint.

The causes of this disease may be shortly stated, as all those which depress the vital powers, viz. a previously delicate and unhealthy childhood, insufficient or improper food, want of pure air and exercise, too close a confinement to study in schools, or to labour in crowded manufactories, the depressing passions, and, in particular, according to many, hope deferred, and disappointed sexual feelings.

In treating the disease, the amenorrhœa must at first be considered as only one of the train of symptoms of disorder of the general health. It is advisable to begin with an active purgative, which will often bring away a large collection of highly offensive motions, with manifest relief to the patient. Small doses of blue pill may be afterwards occasionally repeated, and purgatives of a warm and stimulating character taken every morning, combined with a small quantity of some bitter extract or infusion, until the tongue appears cleaner, and the secretions from the bowels are more healthy. A more decided tonic of the vegetable class, along with myrrh, rhubarb or aloes, and ammonia, will gradually prepare the stomach for the metallic tonics, and above all others for that medicine most useful in these cases, namely iron, which, in one form or another, may be nearly always taken with benefit in a torpid condition of the venous system. Upon the whole, perhaps, the Griffith's mixture (mistura ferri composita of the Pharmacopœia) is the most serviceable of the artificial preparations of iron. At the same time the bowels must be kept fairly opened with the above-mentioned purgatives, those containing aloes being preferable. The diet must be, at first, light and easily digestible; and, as the stomach is prepared for an improved and more nourishing food, wine, meat, and eggs may be taken. Gentle exercise in a carriage or on horseback, particularly the latter, with sea-bathing or the shower-bath, may be ventured upon cautiously as the strength improves. A pure air is very desirable, and on that account, when the patient has a little advanced, nothing is more efficacious than a residence at Tunbridge-Wells, or some other places where chalybeate springs abound, combining the advantages of change of scene, a salubrious atmosphere, amusement to the mind, and the internal use of the mineral water.

With returning health and strength, the functions of health may be expected, and, amongst them, the menstruation; but it often happens that in this particular respect we are disappointed, and we now come to the trial of those remedies which have been found by experience to act either *directly* or *indirectly* in promoting menstruation. For the more complete consideration of this class of medicines, we refer to the article EMMENAGOGUES. It will be sufficient here to mention those which are considered most serviceable at the present day.

Some act by stimulating the neighbouring parts, the rectum and the bladder; such are the more drastic purgatives, aloes and melampodium; enemata of soap or turpentine; tincture of Spanish fly; savine, turpentine, and some of the balsams, internally. A combination of myrrh, aloes, sulphate of iron, and the essential oil of savine, has been found frequently of great utility by the writer of this article. Warm hip-bathing, hot and stimulating *pediluvia*, warm frictions to the hypogastric and lumbar regions, electricity or galvanism applied to the pelvis, have by many been proved beneficial; and it is often of great service to combine with one or other of these plans, the application of leeches to the groins, labia, or os uteri, or to the feet, once a month. Compression of the crural arteries by the tourniquet was formerly much in vogue, by which a larger quantity of blood was thrown upon the uterus. Irritation of the os uteri itself by means of bougies has been proposed, or the injection of a stimulating lotion into the upper part of the vagina, which has succeeded in a considerable number of cases; for this purpose a solution of ten drops of liquor ammoniæ in an ounce of milk has been advised once or twice in the twenty-four hours, and on several occasions the effect has been very rapid. Of supposed direct emmenagogues, the madder and spignel, formerly so much vaunted, have now fallen into disrepute. The only medicines of modern days, which can at all lay claim to that character, are iodine and the ergot of rye. Dr. Coindet, of Geneva, considers the former the most powerful and certain emmenagogue we possess, and attributes its success in bronchocele to the sympathy which the uterus and the thyroid gland manifest for each other. The ergot has been extensively used in various conditions of the uterus, and certainly seems to exert peculiar and powerful action on that organ, which may, perhaps, deserve the name of specific. In the cases before us, it may be tried in the form of decoction, infusion, or powder. The writer has given it frequently, and, in many instances, successfully, in doses of ten grains and upwards, three times a day. In very irritable habits it must be cautiously administered, as it has been found after a few days to produce sometimes violent and even highly dangerous spasmodic effects.

[Dr. Churchill (*Diseases of Females; including those of Pregnancy and Childbed;* Amer. edit., p. 65: Philad., 1843,) thinks that the medicines, of whose power of acting on the uterus there is the least doubt, are iodine, ergot and strychnia; yet it may be questioned whether these, or any agents, have an effect which adapts them for all cases, and merits for them the title of emmenagogues. (See EMMENAGOGUES.) Dr. Ferguson, indeed, (*Library of Practical Medicine*, 2d Amer. edit., iii. 302,) classes these and other agents under the title of "nostrums;" and the truth would seem to be that there is, in the existing state of knowledge, no remedy that acts specially upon the uterus, so as to restore the menstrual discharge when obstructed. They are all indirect agents; and, inasmuch as amenorrhœa may be dependent upon opposite pathological conditions, the remedies have to vary accordingly. (Dunglison's *Practice of Medicine*, 2d edit., ii. 392: Philad., 1844.)]

There is one circumstance to be kept in mind in the management of these cases. The menstrual discharge may be secreted regularly, but there may be no exit, the passage being closed by an imperforate hymen, or an obliteration of the vagina, either from original malformation or from disease. In these cases, in addition to the periodical recurrence of the symptoms of menstruation, there is a gradual enlargement of the abdomen from the retained fluid collected in the uterus, so that unjust suspicions of pregnancy are apt to be raised. A manual examination at once detects the impediment, and it is easily removed by a surgical operation. [The obstacle may exist at the external opening: at other times, a membrane covers the os uteri, or the canal of the cervix may be imperforate. In the last case, Dr. Churchill proposes to make an artificial canal, by means of a trocar, or an instrument resembling that used by Stafford for dividing strictures of the urethra; but it need scarcely be said, that such an operation should be decided upon and executed with exceeding caution. Where a membrane over the os uteri is the obstacle, it may be punctured or ruptured, and a probe or small bougie may be passed into the uterus, as described under DYSMENORRHŒA. (*Practice of Medicine*, loc. cit.)]

II. SUPPRESSION OF THE MENSES.

Suppression of the menses may take place at any time after menstruation has been once fairly established, and may be either *acute* or *chronic;* in the latter case it is most commonly the effect of disorder of the general health, although by females it is apt to be considered as the cause. Acute suppression generally arises from some cause acting immediately previous to or during the menstrual period; such as an attack of fever, exposure to cold or wet, anxiety of mind, frights, or any agitation of a depressing character, a meal of improper or indigestible food, &c. A few years ago, a very interesting case was communicated by Dr. Burrows to the Medico-Chirurgical Society, of acute suppression ending in mania and catalepsy, which was occasioned by sexual intercourse, under very exciting circumstances, during menstruation. Some have argued that in these cases the amenorrhœa is merely the effect of fever excited in the system, and that the secretion from the uterus is checked, as all other secretions are in fever. But this idea is not always correct; for often, during menstruation, the sudden application of cold or wet will stop the discharge, long before the existence of fever, and without any subsequent fever at all. In such instances, if the patient puts her feet into warm water, gets into a hot bed, and takes some diaphoretic drink or medicine, the discharge will return in a few hours. But in many cases the acute suppression is preceded or accompanied by general fever, quick pulse, hot and dry skin, coated tongue, a flushed countenance, violent head-ach, throbbing of the temples, and pain in the back and limbs. In habits at all plethoric, abstraction of blood is desirable; an emetic, followed by an active saline purgative, may be also given; a warm bath, hot fomentations to the abdomen, and diaphoretic medicines, combined with opium, will then be found of the greatest service; and if, after we have reduced the immediate symptoms, the menstruation is still suspended, we may consider it a case of chronic suppression.

Chronic suppression of the menses is either the consequence of a previously acute attack, or is the result of impaired health. In the latter case it often comes on slowly, the menstrual discharge either becoming gradually more and more scanty, or the intervals between the periods being more and more protracted, till at last there is a total suppression. In either of these cases there is much the same train of symptoms as described in the history of *retention* of the menses; but there is almost always much more head-ach and pain in the loins. The causes are also similar, and the treatment varies only according to the peculiar derangement of health which produces or accompanies the suppression. It would be useless to repeat the details, and it will be only necessary to state, that, here even, the discharge may be obstructed by a closure of the vagina from ulceration after a difficult labour, or as the effect of irritating discharges. The possibility of pregnancy should also be kept carefully in view, as the cause of the suppression; and this caution is even applicable to cases of *retention* of the menses, for a previous menstruation is not absolutely necessary for conception, but only that condition of the sexual organs which is directly preparatory to menstruation. Sir Everard Home has stated a case where menstruation occurred for the first time in life, after the birth of more than one child, the second pregnancy taking place during lactation. Professor Frank has related a still more remarkable instance, of a patient who bore three successive children, and never menstruated at all, either previously or subsequently.

VICARIOUS MENSTRUATION.

The consideration of this curious freak of nature is most appropriate to the history of amenorrhœa, because it does not occur except when menstruation is checked. It appears to depend principally upon a torpid or amenorrhœal condition of the uterus; and the periodical evacuation being prevented, either by accidental causes immediately before the expected period, or by a previous indisposition, a larger quantity of circulating fluid is thrown back upon the system, and forces a passage for itself at some distant part. It also usually seems necessary that the vicarious outlet should be already in a weak, irritable, or disordered condition. Accounts are given of this periodical discharge of blood taking place from the lungs, the nostrils, the stomach, or the bowels; and these are not uncommon cases. But instances have also occurred where the flow has been from the bladder, the nipples, the umbilicus, the eyes, the ears, the sockets of the teeth, the skin generally, and also from open ulcers in various parts of the body. It is the practice of some to bleed in these cases, to diminish arterial action; but it does harm, except in very plethoric constitutions, when leeches to the labia, groins, or os uteri, a day before the expected period, would be much more beneficial. The object to be gained, is not only to control and prevent the hemorrhage from the particular part by the proper remedies, but also to rouse the torpid uterus into action. In the intervals of the attacks, metallic tonics, and especially iron, should be freely given, combined with myrrh and aloes; and some of the more direct emmenagogue plans may be tried immediately before the expected period. Opium has proved of great service in many of these cases, combined according to the peculiar condition of the health, and the character of the part morbidly in action. Thus it may be given in conjunction with the mineral acids, or the superacetate of lead, a few days before the expected hemorrhage from the lungs; or in combination with the subnitrate of bismuth, where the stomach has been the vicarious outlet.

[In all cases it is important to inquire into the cause of the aberration, both as regards the system in general, and the uterus in particular; and, moreover, to attend to the condition of the part whence the vicarous discharge proceeds. It has been properly remarked, that the state of the organ probably assists in determining the discharge to it; hence, vicarious hæmoptysis is, perhaps, of more consequence than any other form; and partly, also, because there is danger—even if the discharge should be a mere transudation of blood through the parietes of tolerably healthy containing vessels, that a predisposition may be left to some other pulmonary affection.]

C. LOCOCK.

[AMYGDALITIS. See THROAT, (DISEASES OF THE).]

ANÆMIA. This term is derived from *α*, privative, and *ἁιμα*, blood, and means, therefore, a deficient quantity of the circulating fluid, or bloodlessness.

The hæmatosis, or formation of the blood, is begun in the stomach and completed in the lungs. A morbid state of any one of the organs or functions which concur to effect the hæmatosis may lead to a state of anæmia. It is in this manner that we have a defective state or quantity of the blood in some forms of dyspepsia, especially *chlorosis*. It is in this manner, too, that the workers in certain coal-mines have, from a deficiency in the pulmonary function, been struck with anæmia. A similar state of anæmia has also arisen from disease in some particular organ forming a part of the class of those which contribute to the hæmatosis; a case, the exact seat of which is often obscure. It is scarcely necessary to add, that a state of anæmia is also the immediate result of losses of blood either artificially or by natural hemorrhage. These are precisely the cases to which the term anæmia has been variously and too indiscriminately applied. M. Andral describes anæmia at great length, and has distinguished different forms of local anæmia, or anæmia of the individual organs.

The case of chlorosis, to which the term anæmia has been applied adjectively, will be treated of distinctly in this work. So will the case of anæmia from actual loss of blood. In the present article we purpose to describe, 1. that form of anæmia which has occurred in coal-mines; and, 2. that other form of the disease which has an obscure origin in the morbid condition of some organ contributing to the hæmatosis: 3. to these will be added the view taken of anæmia by M. Andral, and especially the case of local or topical anæmia.

General anæmia is denoted by extreme paleness, especially of those parts which, being covered by the thinnest and most transparent investing membrane, expose the condition of the blood underneath them, as the prolabia, the tongue, the gums, the internal surface of the cheeks, &c. The face, the hands, and the general surface are pallid, and slightly waxen or icterode in their hue. There are vertigo, faintishness, palpitation, and an impaired action of the organs generally, especially of the stomach and bowels, digestion being deranged, with flatulency, constipation, &c.

I. The following description of the anæmia of the coal-miners of Anzain is translated from an account given by M. Chomel, in the article *Anémie*, of the *Dictionnaire de Médecine:*

"All the workmen employed in one of the galleries of the coal-mines of Anzain fell sick in the summer of the year 11, although that gallery had been wrought for some time. The workmen of the adjoining galleries escaped, although the only observable difference was that they were less extensive, and the ventilation less difficult. The disease began with violent colic, with tympanitic distension, black and green alvine evacuations, to which were added dyspnœa, palpitations and great debility. These symptoms subsided in the course of twelve days, and then those of anæmia appeared: the face assumed the colour of wax rendered yellowish by time; the blood-vessels had so entirely disappeared that not a trace of them could be found where they are usually most obvious, as in the conjunctiva, eye-lid, internal mouth; the arterial pulsations were feeble; these appearances continued even during attacks of fever, which came on accidentally in some of the patients: extreme feebleness; great anxiety; slight œdema of the face; palpitations; shortness of the breath on the slightest effort; perspirations;—such were the symptoms: although the appetite was not lost, yet the digestion was imperfect, and there was a progressive loss of flesh.

"This state continued during six months or a year, sometimes terminating in death, preceded by the symptoms which first appeared. The Société de l'Ecole de Médecine was consulted. Four patients were conveyed to Paris, and placed under the care of M. Hallé. A nutritious diet, infusion of hops and gentian, the "*vin antiscorbutique,*" were conjoined with mercurial frictions. During this treatment one patient died; on examination, the arteries and veins were found destitute of coloured blood, and containing only a little serous fluid; incisions through the muscles gave rise to no flow of blood, except a little from those of the thigh. The absence of blood, which was in accordance with the external phenomena, led to the disuse of mercury, and to the substitution of the internal use of iron (limaille porphyrisée,) in the dose of a "gros" daily, under the form of opiate, with tonics. In eight or ten days there was an evident amendment: several veins appeared under the skin of the fore-arm; the digestion improved; the shortness of breath diminished. On each successive day the patients pointed out, as discoveries, new veins, which had not been perceived the day before. The amendment was progressive, and quite complete when these men returned home.

"Similar morbid appearances were observed in some of the patients who died at Anzain. And the same mode of treatment proved successful both there and at Dunkerque, whither some of the sufferers had also been conveyed."

The want of sun and the want of air seem to have been the causes of this singular malady. These important agents appear to be essential to the hæmatosis. [See Air, change of.] The effects of the want of blood are illustrated in an interesting manner. But the consideration of this point is reserved for a distinct article.

II. The origin of the second form of anæmia is more obscure. We shall illustrate the subject by an abstract of a case published by Dr. Combe, in the Transactions of the Medico-Chirurgical Society of Edinburgh.

Dr. Combe first visited his patient in July, 1821. He looked like a man recovering from syncope: the symptoms were pallor, languor, breathing easily hurried, pulse 80 and feeble, tongue covered with a dry fur; the bowels relaxed, the stools dark and fetid; thirst, want of appetite, rejection of food; no pain; no detectible organic disease. The patient was forty-seven, married, of regular habits, and engaged, first in agriculture, and then as a servant to a corn-merchant; he was never blooded. These symptoms had stolen upon him during two months; he said his head troubled him; and the feet were œdematous. Some tonic medicine, a mild nutritious diet, and wine were prescribed. Afterwards iron, mercury, opiates, and astringents were given. Towards the end of September, he tried a sea-voyage, and a chalybeate spring. He died in January, with all the symptoms of hydrothorax. On examination, not a drop of blood flowed on dividing the scalp; the dura mater was moist, and displayed few vessels, and those empty; near the vertex, to the left, there was an ossification; the pia mater was pale, its blood-vessels containing a pale serum, and air; a slight effusion under the arachnoid. The brain was soft and pultaceous, with few vessels, and little difference of colour between the cineritious and medullary portions; the ventricles contained two drachms of serum; and about two ounces were found at the basis. The lateral sinuses were moderately filled with pale fluid blood; the arteries at the basis were empty. In the thorax there were three pounds of a lemon-coloured serum; the lungs were of a pale grey, without any mark of gravitated blood. The pericardium contained an ounce of serum. The heart was pale; the right ventricle contained a pale coagulum; the left was empty. The inner coat of the aorta was of a fine red colour. There was some moisture in the abdomen; the liver was of a light brown colour; the spleen alone was of its natural colour, and soft. The arteries were universally empty, as were the jugular and femoral veins; the lower cava alone contained any blood.

The whole case, and, indeed the whole subject, is exceedingly obscure. It does not appear that any examination of the thoracic duct was made, which is much to be regretted.

III. We now proceed to notice the different forms of local anæmia; and, in doing so, we shall chiefly draw upon the recent work of M. Andral. (*Précis d'Anatomie Pathologique*, p. 73.)

M. Andral traces the cases of local anæmia, 1. to a diminution of the principal artery; 2. to certain affections of the nervous system; for instance, may not the stomach become anæmious like the cheek? 3. to the hyperæmia of other organs; 4. to a previous state of hyperæmia in the organs affected with anæmia; 5. lastly, without being able to trace it to any of these causes, a state of anæmia is sometimes seen in some particular organ. M. Andral adds that he has observed this state of anæmia particularly in the brain, the heart, the liver, the stomach, and some other parts of the alimentary canal, and some of the voluntary muscles.

With a state of anæmia of an organ, that of atrophy is sometimes conjoined.

With anæmia of the membranes, we often observe an augmentation of their secretions; this is seen in the serous and mucous membranes, and in cutaneous textures.

When anæmia is induced in an organ by the sudden obliteration of its principal artery, as by ligature, gangrene is the result.

M. Andral concludes this subject by the important remark, that the symptoms of the anæmia of an internal organ are sometimes observed during life: convulsions and delirium arise from anæmia, as well as hyperæmia, of the brain. Similar states of the stomach may lead to their peculiar symptoms respectively.

It is, indeed, quite plain that the state of anæmia, of which the actual loss of blood is one of the most frequent forms, leads to phenomena which require to be carefully distinguished and appropriately treated. For the fuller discussion of this important subject, we refer our readers to the article BLOOD.

MARSHALL HALL.

[ANÆMIA is generally applied to that condition of the system in which there is paucity of blood: more properly it might be termed *Hypæmia*, or *Oligæmia*. It likewise includes that condition in which the watery portions of the blood predominate largely; or what has been called *Hydroæmia*, or *Hydræmia*.

When blood is drawn from a patient affected with general anæmia, it is found to possess a smaller proportion of crassamentum, and this is loosely cohering: the quantity of serum, on the other hand, is greatly augmented. The essential character of the blood of the anæmic is the opposite to that of the plethoric—paucity of globules. In 16 cases of incipient anæmia, M. Andral (*Hæmatologie Pathologique*, Paris, 1843,) found the proportion to be 109 in place of 127, the healthy proportion; and in 24 cases of confirmed anæmia, 65. In spontaneous anæmia, slight or considerable, he found the globules, alone, diminished in quantity: the fibrin and solid matters of the serum possessed the healthy proportion. In the anæmia that follows hemorrhage, the globules, alone, may have their proportion diminished, but if the hemorrhage should augment, or be renewed, the blood soon begins to lose some of its other principles, and, along with the globules, the fibrin and the albumen of the serum diminish. In anæmia induced by inappreciable modifications of the organism, the composition of the blood was affected as in spontaneous hemorrhage: thus, the globules alone were found to be diminished, the fibrin and albumen of the serum remaining the same. This was the case in several pregnant females, whose blood had lost globules without any diminution of its fibrin. Andral found the mean proportion of globules in them the same as in cases of slight anæmia.

Owing to the proportion of fibrin to the red globules being increased, the buffy coat is not an uncommon phenomenon in anæmia, and especially in chlorotic cachexia (see CHLOROSIS); for it appears that whenever there is an increase in the proportion of fibrin to the red globules, and, at the same time, the coagulation of the blood is not too rapid, the fibrin accumulates at the surface of the blood, and the buff appears.

Whenever a certain diminution takes place in the proportion of the globules, a bellows' sound is heard on auscultating over the arteries. According to M. Andral, this is connected with the impoverishment of the globules, inasmuch as it is not heard when the fibrin alone is diminished in quantity. The same sounds are heard as in chlorosis (q. v.). Chlorosis, indeed, belongs to anæmia; and amenorrhœa is not unfrequently accompanied by the same anæmic condition.

The different functional phenomena, which are characteristic of anæmia, generally occur in a gradual manner, and it is long before they induce so much disease as to cause death. In the very thin state of the blood that accompanies it, hemorrhage readily occurs from parts in which the vessels are but loosely protected by the tissues in which they creep,—as from the mucous membranes,—the gastro-intestinal especially,—and these hemorrhages greatly hasten the fatal termination, both by the increased exhaustion which they induce, and by their laying the foundation for hydropic, or other mischief.

On the dissection of those who have died of anæmia, the tissues have been found pale, and the vessels and heart almost exanguious. The heart, too, is often atrophied, and its tissue softened and flabby, especially if the disease has been of long duration. The intestinal canal is frequently also pale, and the serous cavities and cellular membrane are infiltrated with serous fluid.

In the treatment, it is all important to inquire into the pathological cause, and to remove it, where practicable. In almost all cases, it is essential to put the patient on nourishing diet, and especially where the anæmia has been caused by imperfect nourishment; yet care must be taken in the very impressible condition of the system which exists in these cases, that undue excitement be not induced. The respiration of pure air is likewise all important.

The best therapeutical agents are, the preparations of iron,—the iodide, subcarbonate, citrate, lactrate or tartrate, for example. The iodide, in the writer's experience, is the best form. Dr. C. J. B. Williams, (*Principles of Medicine*, Amer. edit., by Dr. Clymer, p. 143, Philad., 1844,) considers it to be most speedily efficacious. It not unfrequently, however, disagrees, and it becomes necessary to substitute one of the other preparations. The different mineral and vegetable tonics may be given, but they have less efficacy. To relieve the nervous erethism that always exists to a greater or less degree, the hydrocyanic acid is well adapted; and a full dose of opium will often allay the excessive vascular and nervous tumult that sometimes prevails. Under careful management, with the observance of the strictest mental and corporeal quietude, the blood may gradually become improved in its constitution, and the phenomena of anæmia gradually disappear. (*Practice of Medicine*, 2d edit., p. 456, Philad. 1844.)

ROBLEY DUNGLISON.

ANÆSTHESIA. See PARALYSIS.]

ANASARCA: from *ἀνὰ*, through, and *σάρξ*, flesh. The word used by Celsus, and other ancient writers, is *ὑποσάρκα*; or, as is explained by Cælius Aurelianus, *aqua subter cutem*.

Anasarca occurs under many different states of the system: it essentially consists in the effusion of serum into the meshes of the cellular tissue, and may take place wherever this structure exists. It has usually been described as a peculiar species of dropsy, and is frequently treated of under this head by authors. Such a plan is, however, attended with very serious inconvenience; as, in every species of effusion, the immediate condition of the exhalents varies but little, while that of the preceding series of vessels often differs most materially. What these different conditions are, we shall endeavour to explain under the general article of dropsy. In the present article our purpose is to give a clear account of the different circumstances under which anasarca takes place; premising, at the same time, that in some cases which we shall here treat of, the anasarca is only the chief symptom, and that ascites, and even hydrothorax, are occasionally joined with it.

Anasarca occurs very frequently as an acute disease; but in this case it is usually accompanied with the inflammation of some viscus; and in most cases it is the lungs which suffer. The dropsy described by Dr. Abercrombie, and to which the attention of the profession was drawn a few years ago, is of this description: "The disease comes on suddenly, and generally affects persons in the vigour of life. It is usually ascribed to sudden exposure to cold, especially after the body has been previously overheated. The first symptom is an oppression and uneasiness in breathing; and, in a short time, frequently in a few hours, or in the course of the same day, this is followed by the dropsical swelling. The affection of the breathing varies considerably in different cases. In some cases there is only a feeling of oppression or tightness in breathing, without pain or cough: in others there is pain, increased by a full inspiration, with sharp painful cough; and in others there is great oppression of breathing, preventing the patient from lying down, except in one particular posture, or even preventing him from lying down at all. The pulse is, in some cases, a little frequent; but in others it is not above the natural standard. It is sometimes of good strength, but frequently rather weak, and in some cases irregular. This anasarcous swelling is commonly observed first in the face; from thence it extends downwards upon the trunk of the body, and then to the extremities. This progress was, in one case, so remarkable, that, even at night, after the patient had been sitting up through the whole day, he was affected with a great degree of anasarca down to the middle of the legs, while the feet and ankles were free from it: next day the feet and ankles were affected also. This peculiarity, however, does not occur universally, for in some cases the swelling is first observed in the legs: but, in general, the face is affected at a very early period. The urine is scanty and high-coloured: in some cases it is coagulable; in others there is no trace of albumen. If the disease be now allowed to go on, the swelling increases, and the breathing becomes more and more oppressed; it may be fatal in a few days, or it may be drawn out to several weeks."

Dr. Abercrombie remarks, with regard to the diagnosis of this disease, that the affection of breathing may exist without pain and without fever, and that, consequently, there may be some danger of mistaking it for actual effusion into the chest. With the view which we have of some of these affections, such an error would not always be very important; because, if we had other evidence that inflammation were present, the occurrence of effusion would not prohibit the most active antiphlogistic remedies. But in all the cases which we have seen, there has been manifest pulmonary inflammation, which, if it could not be recognised by general symptoms, is always easily distinguishable by means of the stethoscope. In this, therefore, as in so many other cases, the stethoscope is a most important assistant in arriving at a correct diagnosis.

The appearances found on dissection sufficiently prove that this affection is of an inflammatory nature, and, of course, equally prove the propriety of active antiphlogistic treatment. The extent to which this can be carried varies necessarily with the condition of the disease and the constitution of the patient. In more recent and lighter cases, a single bleeding, or even a few leeches, will be sufficient to remove it; in other cases it requires the greatest firmness and determination to carry this remedy sufficiently far.

A very important illustration of the value of bleeding is given in the *Edinburg Medical and Surgical Journal*, by Dr. Graham; for in very few cases has depletion been carried so far, even with impunity; in still fewer has it, when thus employed, been attended with success. It is calculated to caution as well as to instruct. The inflammatory symptoms were detected by the rare acumen of the physician, and his diagnosis being correct, his treatment was consonant to his diagnosis. He had, at the same time, a young man of full and vigorous constitution to treat; and, with this adjunct, his success was striking. But it becomes all who shall dare to carry depletion as far as Dr. Graham carried it, to unite his sagacity with his boldness; for should the same treatment be adopted in cases which have not an inflammatory origin, or should the patient have a less sturdy constitution to endure the remedy, the result would most likely be fatal.

ANASARCA FROM THE RETROCESSION OF ERUPTIONS.

The anasarca, which succeeds scarlatina, has been mentioned, by Dr. Abercrombie, as analogous to that which has been just described, and, as it appears to us, with considerable reason. The first, and hitherto the best account of this disease has been given by Dr. Wells, in the third volume of the *Medical and Chirurgical Transactions.* Though this disease has frequently occurred in our practice, we have never yet met with a fatal case; for the morbid anatomy of it, therefore, we are indebted to Dr. Wells's paper and to Dr. Abercrombie. Burserius, from whom Dr. Wells quotes, has remarked that the bodies of several persons who had died of the disease about 1717 having been opened, the lungs, pleura, intercostal muscles, diaphragm, kidneys, and intestines, were found more or less inflamed; that peripneumony having hence been considered the original disease, and the dropsical swelling only as a consequence, blood was taken from the arm in the succeeding cases, once or oftener, as the occasion required; and that no one afterwards died of the dropsy who was thus treated.

Dr. Abercrombie, in the *Edinburgh Medical and Surgical Journal* for April, 1818, has related the case of a child two years and a half old, who, about eight or ten days after he had recovered from a mild attack of scarlatina, was observed to be anasarcous in the face; the swelling increased, and extended over other parts of the body; at a very early period of the complaint his breathing was oppressed; the pulse frequent, and rather small; the urine very scanty. The swelling increased; the breathing became more and more difficult; all the usual remedies were employed without benefit, and the child died about the tenth day from the first appearance of the anasarca. On dissection, considerable effusion was found in both cavities of the thorax, and a little in the abdomen. The lungs were dark-coloured and remarkably indurated, so as to resemble the structure of the liver. This was most remarkable in the right lobe; pieces cut from which sank in water.

The following case, extracted from Dr. Blackall's work, proves still more clearly the inflammatory origin of dropsy succeeding scarlatina. Sarah Elliot, æt. 30, was brought into the Devon and Exeter Hospital, 1800,—in a state of great distress, labouring under universal anasarca, and an erysipelatous inflammation of the lower extremities, with much discharge and deep sloughs on the hips and sacrum. The urine coagulated, although not to the extent sometimes observed, and it flowed freely, as it is often known to do, whenever much serum is discharged from the legs. She had the remains of a florid and sanguine temperament, and had been in good health, till about two months before, when she was attacked with fever, with great redness of the face and extremities: soon afterwards she became dropsical, and complained of sense of stricture in the chest, cough and pain under the left breast. She took large doses of cinchona with great advantage. She was quite inundated with the discharges from the legs, and the increased flow of urine. The erysipelas disappeared, and shortly after all vestiges of dropsy: but the above-mentioned sloughs had penetrated deeper than was anticipated; the bones became carious, and, about two months after, she died exhausted, the anasarca never having returned.

On examination after death, the kidneys were found rather soft and flaccid, and more loaded with fat than could have been supposed after so long an illness, but in other respects appeared natural. There was no morbid appearance in any any other viscera of the abdomen.

The pleura of the left lung bore marks of inflammation, more severe than the common adhesive, for several small flakes and granula of coagulated lymph covered it in several parts, principally in a spot answering to the seat of pain during life; and that membrane was separated from the body of the lungs for about the size of a shilling, by a very small deposition of pus. Opposite the same spot the pleura costalis was inflamed. In other respects the substance of the thoracic viscera was sound, and there was no unusual quantity of water in the cavities.

These two cases sufficiently attest the nature of this anasarca, and we shall proceed to its history.

We have already stated that it succeeds the retrocession of the eruption in scarlet fever, but seldom earlier than three weeks from the commencement of the fever. It has never, within our knowledge, been observed to appear upon the sudden retrocession of the eruption, nor is it peculiar either to a mild or severe attack of fever. In all the cases which have fallen under our own care, the patient has never entirely recovered from the scarlatina, but has remained languid and fretful. The sore throat has either partially, or, perhaps, entirely disappeared, and the appetite has slightly returned. In short, the patient has appeared convalescent. In this state, however, the patient has remained day after day: the same languor has continued; the tongue, after having become cleaner, has again been furred, and the appetite, though not so defective as during the fever, has been exceedingly capricious. The bowels are, at the same time, usually costive, and sometimes both sickness and vomitings accompany it.

After this has endured for several days, or sometimes a month, the face is observed to be rather puffed, particularly on first rising in the morning: this rapidly increases, and the anasarca in a day or two extends over the whole body. According to Dr. Wells, however, it is rare for the whole body to be affected: and he states likewise that the hands are more readily affected than the feet. During this time there is also frequently much torpor, and we might be induced to suspect that effusion had taken place into the brain. In a case which presented itself at the Birmingham Dispensary last year, the anasarca had come on very suddenly, and the child completely lost all power of articulation, which, though he lived for several months afterwards, he never recovered. The dropsy had disappeared long before his death, and, from what we could learn, he died from phthisis. He was not, however, in Birmingham at the time of his death, and, consequently, no examination was made of the body. The pulse is frequently slower than in health. In a boy five years old, examined by Dr. Wells, it was only fifty-eight in a minute on the first day of the disease; on the third day it became quick, and continued so throughout the disease. In the beginning of the disease the urine is always scanty, and very quickly becomes turbid, after it has been passed. Dr. Wells says, "I have in several cases allowed the urine in this stage of the disease to remain undisturbed for several hours, when it has assumed an appearance not hitherto observed by me in any other disorder. For there was at the bottom a very white flocculent matter, and above, a fluid of a pale white colour, and somewhat turbid; the whole resembling a mixture of soft curd of milk and whey, when the latter has floating through it small particles of the curd. The patients, though they make but little water, have sometimes a frequent desire to discharge it, and in this case a pain is felt by them in the region of the bladder when it is pressed." This appearance of the urine is owing to the presence of the serum of the blood, which may easily be ascertained by boiling it. Sickness and vomiting are frequently present in this disease, but they are commonly indicative of affection of the brain, and always ought to lead to a suspicion of it. Costiveness is not more attendant upon this than many other complaints, but in very young children the removal of constipation frequently effects the cure of the anasarca.

According to Dr. Wells, symptoms of extreme danger sometimes appear as early as the third day after the face has begun to swell. When the disease has continued mild for ten or eleven days, we never knew it give much alarm afterwards.

The appearances of danger are various. Sometimes they arise from an affection of the head.

"A girl, eight years old, on the morning of the third day of the disease, complained of head-ach, which in the course of the same day became extremely violent. In the evening she was seized with convulsions, which, from the report of her mother, continued nineteen hours, with scarcely any intermission. They then ceased, but returned in two hours. In this interval it was discovered that she was blind, and that her pupils were much dilated. The convulsions, after they returned, continued thirty-six hours; and the patient remained blind eight hours after they left her. This child recovered. Her swellings, which were confined to the face and hands, disappeared while the convulsions were present, but returned after they had ceased." Dr. Wells remarks, that he had "observed dropsical swellings, from other causes than scarlet fever, disappear during the presence of convulsions."

We have already mentioned a case where the articulation was suddenly lost, and Dr. Wells has related one in which convulsions following anasarca from scarlatina, proved fatal.

In other cases the danger seems very clearly to arise from disease of the abdomen.

"A boy seven years old, who had shortly before laboured under scarlet fever, was attacked with dropsy, which, on the eighth day after its appearance, the first of my seeing him, occupied in a slight degree the whole surface of the body. The fever had commenced with vomiting and purging, and these symptoms appeared again two days before he began to swell. On the eleventh day he complained much of a pain in the bowels; vomiting and purging attacked him a third time, and he died in the course of the night. His stools were scanty and slimy."

In the following case, which is taken from Dr. Crampton's Clinical Report of Dropsies, together with his observations upon it, the effusion did not certainly occur after scarlatina, but it is most clear that the author's opinion respecting its similarity to that form of dropsy which does occur after scarlatina, is correct.

A pale, thin, but muscular man, who had lately recovered from the epidemic fever in the Hardwicke Hospital, was attacked, on exposure to cold, with pains in his bowels, diarrhœa, and passing of blood; immediately after this, ascites to a considerable degree came on, with anasarca of the face, legs, thighs, and scrotum; pulse eighty, urine scanty and high-coloured, respiration unaffected.

He was directed venesection to ten ounces; after this his pulse was reduced in frequency, and the urine increased; blue pill and cream of tartar were given; his swellings very soon subsided, and he was discharged cured on the 10th of October.

In this case, "the mucous membrane of the intestines first showed symptoms of disease; on the subsidence of this, all the serous membranes of the body, including all the cellular substance of the skin, as well as the peritoneum, being in an excited state after fever and exposure to cold, they readily took on them an inflammatory disposition, which soon ended in effusion. This is the kind of dropsy which frequently follows scarlatina, measles, and small-pox: had venesection been resorted to in the dysenteric stage of this complaint, no dropsy would in all probability have ensued."

Now, if we compare these two cases, their similarity will be as striking as their terminations were different; nor is it difficult to account for this difference, since Dr. Wells, to whom we owe so much, though he suggested the propriety of bleeding in this species of the disease, acknowledges that he had never employed it; whereas, Dr. Crampton's patient was bled, and the regimen was antiphlogistic.

Another source of danger in the anasarca after scarlatina arises from effusion into the chest, always the consequence of preceding or accompanying inflammation of the lungs. In this case, the symptoms are precisely those enumerated by Dr. Abercrombie.

Anasarca appears also after the measles, but there is no difference between it and that form which follows scarlatina. The same remark may be made when it follows the retrocession of chronic cutaneous diseases, which is by no means rare.

A girl, twenty years of age, had been subject for some months to an impetiginous affection of the whole body, but more particularly of the arms and hands, for which she at length applied to the

Birmingham Dispensary. After attending about a week, the eruption suddenly disappeared, and she was attacked at the same time with inflammation of the lungs and general anasarca. She was bled from the arm to the extent of twenty ounces, with great relief to the lungs, and the blood was buffed and cupped. The next day the dyspnœa had slightly returned, and she was again bled with a similar result. Mercurial purgatives were given at the same time. It was necessary, a few days after, to repeat the bleeding again, from which time the anasarca rapidly disappeared, but she did not recover her breathing completely till the impetiginous affection had re-appeared.

If it be necessary to make any remark upon anasarca after the retrocession of these pustular eruptions, it would be to say, that it is, perhaps, more acutely inflammatory than after scarlatina, and usually demands more decided and active antiphlogistic treatment.

Anasarca sometimes accompanies or succeeds urticaria. It is seldom, however, an important disease, and generally yields to active purgatives.

In considering the treatment of anasarca after scarlatina, our first object must be to obtain an accurate diagnosis, both as to the nature of the affection, and the particular organs which are interested. That it is always an inflammatory disease may not, perhaps, be maintained without exception; because we know that anasarca is as frequently a consequence of debility as of inflammation; but, unquestionably, in the very great majority of cases its character is inflammatory. This, then, being decided, the particular organs which are affected is the next object; and these are, the brain, the lungs, the heart, the liver, the peritoneum, &c. In whichsoever of these the inflammation is present, immediate attention must be paid to it. Bloodletting is the first remedy demanded, and in almost every case this may and should be general. Should, however, the head be affected, it will be sometimes useful to apply a blister to the nape of the neck immediately after the bleeding. If we suspect the pericardium to be inflamed, it will be proper to apply leeches to the region of the heart, as well as to bleed from the arm; and, indeed, this local bleeding is most important. Corvisart has remarked that blood taken from the region of the heart is much more efficacious than when taken from the system at large, and our own experience has amply confirmed the remark. It has not the disadvantage of producing that general and distressing debility which always must result from repeated venesection. When inflammation of the peritoneum is present, which is easily known by the tenderness on pressure, the tension, and the anguish of the countenance, always produced by inflammation of this membrane, leeches in great number ought to be applied over the surface of the abdomen, and the bleeding encouraged for a considerable time. Recourse should be also had to fomentations, which should be as hot as the patient can bear them, and be very long continued, indeed, as long as any tenderness remains,—supposing, however, that this is not prevented by the application of a blister.

In inflammation of the mucous coat of the intestines, which is indicated by tenesmus, discharge of blood, pain in the bowels, with much flatulence, and aggravated during every evacuation, &c., the best situation for the application of leeches is the verge of the anus, and the quantity must be regulated by the severity of the attack and the strength of the patient. Sometimes vomiting is present, and should it not be relieved by the bleeding, it will be right to give some opium. In enteritis, as in peritonitis, fomentations are both useful and important.

We proceed to speak of the medicines which should be given in this disease. In every case it will be right to act upon the bowels, (excepting, however, in those cases in which diarrhœa is present, of which we shall speak presently,) and care should be taken that they be thoroughly evacuated. For this purpose we shall seldom find a better combination than calomel and jalap, but they should not be continued after the bowels are well opened. Sometimes individuals will be met with upon whom this medicine will not act as a purgative, even though frequently repeated; and recourse should then be had to an infusion of senna, with sulphate of magnesia. When the bowels have been evacuated, purgatives should be suspended, and mercury on no account should be persevered in. The danger of persisting in mercury is so strongly insisted upon by Dr. Blackall, and so completely agrees with our own experience, that we gladly avail ourselves of his authority. "There are," says this enlightened physician, "no cases more satisfactory or more creditable to the practitioner, than those fevers of children with an oppression of the head, in which a bold use of calomel brings off black discharges, and the patient from that moment recovers. Without inquiring here whether hydrocephalus is not thus cured which never existed, I wish to confine myself to that dropsy, when distinguished by the presence of serum in the urine; and to state that after scarlatina, the tendency to this alarming conversion is increased under the use of mercurial purgatives; that during the exhibition of two grains of mercury alone every night, which did not purge, the anasarca has disappeared, and the mouth become affected, and that there cannot be a more hopeless or more painful task than that of submitting to the miserable routine of salivating such patients."

When the inflammation has been subdued, and the bowels opened, supposing that these means have not been sufficient to remove the dropsical effusion, diuretics should be employed; and certainly in no disease may more perfect reliance be placed upon digitalis than in this. In administering, however, this medicine, it is of great consequence to watch its effects, and to be certain of the manner in which it has been dried. Some years ago the writer of this article employed the infusion to a great extent without producing any effects. Occasionally, perhaps, the urine might have been a little increased, but no change whatever was caused in the pulse, although as much as an ounce and a half had been given three times a day. Surprised at this result, he at length requested to look at the dried leaf; and, instead of finding it quite green, it was as black as charcoal, and the whole matter was explained. No effect could be expected from it in such a state.

Sometimes the digitalis may be beneficially combined with other diuretics, particularly the squill and the liquor ammoniæ acetatis. A very powerful diuretic, also, occasionally in this disease, is the spiritus colchici ammoniatus; and we have often succeeded with this medicine in exciting the secretion of the kidneys, when we had failed with many others. It may, however, be remarked generally of diuretics, that they bear, and even require, to be united together more than any other medicines; and we have often thought that their effect has been in proportion to the complexity of the prescription. Thus, perhaps, when neither squill nor foxglove has succeeded alone, they have acted when united; and it will often be well to join them with others. The sulphate of magnesia, when combined with squills, paregoric, and the liquor ammoniæ acetatis, has often a very decided effect upon the kidneys, and either does not act at the same time upon the bowels, or only in a very slight degree. The following formulæ have been very useful in our own practice:— ℞ *Liquor. ammoniæ acetat.* f.℥ii.; *T. camphoræ comp.* f.℥i.; *T. scillæ* f.ʒi.; *Magnesiæ sulphatis* ℥i.; *Infusi Taraxaci* f.℥iv.; à f.℥ss usque ad f.℥iss tertià quàque horà. ℞ *Sp. colchici ammoniat.* f.ʒii.; *Potassæ subcarbon.* ʒi.; *Infusi genistæ* f.℥viii.; ab f.ʒss usque ad f.℥iss tertià quàque horà.

[Diuretics of the stimulating kind are not, however, adapted for all cases of anasarca, and especially for those that are dependent upon granular disease of the kidney. In ordinary cases, where no visceral disease contra-indicates their use, recourse may be had with full advantage to the infusion of juniper-berries, alone, or associated with the bitartrate of potassa. A solution of the bitartrate may also be given for common drink; and along with these a grain of squill and half a grain of the mild chloride of mercury may be given twice or thrice a day until the mouth is affected slightly. This course, along with the employment of a brisk cathartic, as the pulvis jalapæ compositus twice a week, offers as well-grounded prospects of advantage in simple anasarca as any that could be devised. (Dunglison's *Practice of Medicine*, 2d edit., p. 649. Philad., 1844.)]

When the anasarca has completely assumed a chronic form, and appears almost stationary, Bacher's pills are extremely valuable. In the original formula they contained powdered carduus benedictus, but this is perfectly inert. The formula is contained in Thomson's Conspectus, under the head "Extractum hellebori nigri." Under their use the effusion often gradually disappears without any extraordinary increase in the secretions. Occasionally they act upon the bowels, producing, however, tenesmus much more frequently than actual diarrhœa; their more manifest effect is in slightly stimulating the secretion of the kidneys. In some instances their exhibition, after a few days, is followed by the peculiar effects of poisoning from hellebore, head-ach, giddiness, fainting, &c., together with irritation of the mucous coat of the intestines. Of course the medicine, under these circumstances, must be suspended; they may, however, be generally resumed again in a few days without any ill consequences.

In what is connected with the treatment of this disease, nothing has been said of those cases in which the effusion is preceded or accompanied by diarrhœa. Where this has an inflammatory origin, as is generally the case after scarlatina and other repressed eruptions, blood-letting has been already recommended; and the only question that remains to be considered is that of purging. Now, though diarrhœa may arise, in the first instance, from simple inflammation, or irritation of the mucous membrane of the bowels consequent to the preceding eruption, it will certainly be maintained and aggravated by any accumulation within them; and, consequently, to take care that such accumulation has not place, is a most important duty of the practitioner. Here, however, he will often be beset with difficulties; for should the diarrhœa be violent, there will be such a general exhaustion of the system, that to purge at once will be to ensure a fatal result. The mode of proceeding, therefore, must first be, to maintain the system by opiates, and this even should leeches be employed at the same time; for it is a curious circumstance, but we believe perfectly true, that patients will often better bear the loss of a small quantity of blood than the debility resulting from severe purging. When rallying has occurred, it will be proper to regard the state of the bowels; and if accumulation be suspected, to administer a mild aperient, such as castor oil, or an infusion of senna combined with some carminatives; thus simply ensuring the evacuation of the intestines, without exciting in any violent degree the secernents of the mucous membrane. After the diarrhœa has subsided, the treatment in no way varies from that which has already been laid down.

In distinguishing inflammatory from asthenic dropsy, much stress has been laid by Dr. Blackall upon the presence of serum in the urine; but upon this point we have made no remark, having no dependence upon it as a guide of practice. That it is never present without inflammation is, perhaps, true; but to make it really a test, the converse ought also to be true, viz., those dropsies in which it does not contain serum ought never to be conjoined with inflammation. This, however, is by no means the case; and our experience accurately coincides with Dr. Crampton's. "In many of those," says this author, "which appeared to me to require the prompt use of the lancet, the urine did not coagulate. Under this impression, I ceased to draw any practical inference from that appearance;" and he adds in a note, "Dr. E. Percival, who was my predecessor as one of the physicians to the House of Industry, mentions that the result of his experience on this subject fully coincides with mine. After he had tried dropsical urine by the test of coagulation in a number of cases, he at length lost all confidence in the test, either as an invariable evidence of inflammation, or as a guide of practice. His statement is likewise confirmed by the additional testimony of Dr. Reid, who acted as a clinical clerk at the House of Industry at the time those experiments were made." We would much rather, therefore, recommend that reliance be placed upon general symptoms than upon the state of the urine only, which, at the most, can only be regarded as an auxiliary to our diagnosis.

The observations which have hitherto been made, regard acute anasarca as an inflammatory disease. This, however, is not always the case. The following extract from Dr. Bateman's Reports of the Diseases of London, shows that it may be the result of a debilitating cause, and require a tonic treatment. "The patient was a middle-aged woman, in previous health. She was thrown into a state of extreme fright and alarm, on discovering in the evening that she had lost her little store of money, the savings of several years, and the next morning she was anasarcous from head to foot. By tonics, combined with diuretics, the disease was speedily removed."

The last modification of anasarca to which we shall advert is that in which its pathology is very obscure, viz., when the effusion is connected with disordered states of menstruation. Dr. Abercrombie affirms that such modifications of dropsy have been too indiscriminately classed among the cachectic diseases, and referred to a debilitated state of the system.

Sauvages relates the case of a young woman who became suddenly dropsical over the whole body a few days before the menstrual period; when the menstrual discharge took place, the dropsical swelling disappeared. The swelling returned at the same time and disappeared in the same manner for several successive periods, till at length, by a course of treatment which he describes, it was prevented from taking place.—Sauvages Nos. Meth. vol. ii. p. 471.

Hoffmann describes the case of a woman, thirty years of age, previously strong and healthy, in whom the menstrual discharge was in general remarkably copious. Having suffered from a fright immediately before the menstrual period, the discharge did not take place, and she was seized with languor, loss of appetite, and dropsical swelling to such a degree that the integuments on the feet burst and discharged serum in great quantity. The menstrual discharge having taken place at the next period, all these complaints were removed.—Hoff. Med. Rat. (*de Hydrope.*)

Similar symptoms have been occasionally observed in connexion with suppression of hemorrhoidal discharge after it has become habitual.

Dr. Abercrombie adds, these cases certainly indicate a state of the system very different from that which we understand by the term cachexia. Such affections are usually treated upon the plan of merely evacuating the effused fluid. It forms an interesting subject of investigation whether they would not admit of much more active treatment.

A similar affection occasionally supervenes in females about the period of the cessation of the catamenia. The anasarca comes on slowly and insidiously, and is in general best treated by small bleedings and purgatives, with restricted diet, and confinement to the horizontal posture.

Excessive menorrhagia is not unfrequently followed by anasarca. It occasionally occurs in young females when the menstrual secretion is profuse. In these cases a considerable quantity of coagulated blood flows from the uterine vessels for the first two or three days of the menstrual period. Slight effusion in the lower extremities, and sometimes on the whole body, takes place, with considerable weakness. Such cases are very little under the control of treatment, unless the hemorrhagic action, on which the effusion depends, be checked.

[Few topical applications are of much benefit. The laced stocking, or any ordinary bandage, has been advised to aid absorption, and to afford support. When the integument becomes inflamed, as it often does in cases of great distension, washes of subacetate of lead, or weak creasote water, may be prescribed along with the gentle support of the bandage; but in most cases a warm, soft poultice will prove more serviceable. When there is apprehension of spontaneous rupture of the integument, it may be advisable to evacuate the fluid by punctures with the point of a lancet. Where the vitality of the parts has been greatly depressed by the protracted pressure of the fluid, gangrenous inflammation sometimes attacks them. To guard against this, the punctures ought not to be too numerous or too close together. As the fluid is discharged, a gentle and equable pressure should be made, by means of a bandage, on the distended integument. The operation of acupuncture has been used advantageously to drain off the fluid. In such cases, larger needles than those in common use are needed. Some prefer them of the size of an ordinary glover's needle, and of a triangular shape,—a puncture of this kind being less likely to close. (*Practice of Medicine*, p. 651.)]

ANASARCA FROM ORGANIC DISEASE.

Anasarca is also a common consequence of several organic diseases, and its treatment admits of some modification according to the organ originally affected.

In all chronic diseases of the heart, if the patient is not carried off suddenly, anasarca ensues towards the termination of life. It usually begins in the face, and the first symptom perceived is the swelled or puffed state of the eye-lids on rising in the morning. To this in a short time succeeds anasarca of the lower extremities, gradually extending upwards, and at length involving every part of the body. Hydrops pericardii and hydrothorax are also usually present.

[The most common cause of dropsical infiltration unquestionably is, an impediment to the circulation of the blood, either in the great central organ, or in some portion of the venous system. Very frequently this impediment to the circulation in the heart appears to consist in a morbid condition of the valves, which, owing often to dilatation of the cavities of the heart, become insufficient to close the openings, and, consequently, seriously disturb the circulation of the blood through that organ. This insufficiency, as a cause of dropsy, would appear to exist most frequently in the tricuspid valve.]

The treatment of anasarca dependent upon disease of the heart must be very much guided by the general symptoms which may be present at the same time; for it must be remembered that the obstruction to the flow of blood through the heart is very apt to produce congestion and even inflammation of the lungs. If this be present, therefore, an antiphlogistic treatment must of course be adopted. But it may also be the result of mere debility, and the principal inconvenience may result from the effusion itself. The latter state chiefly occurs in very old cases; the former is common when chronic disease of the heart occurs in young persons, and of an irritable temperament.

The following case exhibits the appearances which are frequently found in young persons, and affords a strong illustration of the proper mode of treatment.

A young man, only thirty-two years of age, had suffered for two years from disease of the heart. A fortnight before his death, his lower extremities became œdematous; he was attacked with violent palpitations, dyspnœa, and hæmoptysis. He was bled, and the usual remedies were resorted to; but the attacks of palpitation continued to increase in violence, the effusion increased, and he died on the fourteenth day from his first confinement to the house. On dissection the lungs were found externally healthy, but generally œdematous and gorged with blood; and the inferior lobe of the right lung was completely hepatized. The heart was enormous, but principally from distension of the right cavities. Their parietes were thinned, and they were at least double their usual capacity. The left cavities also were larger than usual, and the mitral and semilunar valves were in a semiosseous state. Both passages were greatly narrowed.

The above case is sufficient to show that sometimes bleeding may be necessary in anasarca arising from disease of the heart; but this is not the place to pursue farther the appearances in hydrothorax with which the external effusion is usually united. They will more properly appear under that head.

With regard, then, to the treatment of anasarca depending upon disease of the heart, we have first to consider its character. If inflammatory, or even attended with much congestion, bleeding will be very necessary; in other cases, and where the principal inconvenience arises from the effusion, we shall derive the best assistance from purgatives and digitalis. In all these cases, however, we can only regard these medicines as capable of affording relief: the anasarca will unquestionably return repeatedly, unless the original disease can be removed.

Of the purgatives which are recommended for the removal of anasarca, elaterium appears to deserve the preference. As a hydragogue, indeed, it is not excelled. The formula which we have always employed, is that described by Dr. A. T. Thomson, viz. ss. gr. of extract of elaterium, with five grains of extract of gentian, given every hour till watery evacuations are procured; and so successful has it proved, that we have never been tempted to change the combination. In giving this very powerful medicine, however, considerable care ought to be taken that it be not continued too long. In one instance, where, from the great relief which the patient had derived the preceding time that he had taken it, he continued it much longer than he was ordered, most violent hypercatharsis ensued, and he became for a short time completely maniacal. The delirium went off after a few hours, and so successfully had the elaterium emptied him, that a much longer period than usual elapsed before the effusion became again inconvenient.

In order to be of much service, the elaterium should be repeated every two or three days for a fortnight, when it may generally be suspended for a short time. Occasionally given in this manner, the dropsical effusion disappears for several months, until it is again excited by cold or some accidental aggravation of the disease of the heart.

Another remedy which of late years has been much recommended, is the croton oil: the chief objection to it is its uncertainty. Upon some individuals a single drop acts very violently, while upon others it appears to be perfectly inert. We have given as many as five drops to one patient, of the same preparation which caused upwards of thirty large watery evacuations in another patient who took only a single drop. When it does, however, agree with the constitution, it is in some respects preferable to elaterium, as the patients sooner overcome its debilitating effects.

It often happens that with disease of the heart some disease of the liver is combined; and here mercurial purgatives, joined with diuretics, are frequently very useful During the last year we succeeded in removing the dropsical effusion by a powder of calomel and jalap every morning for a fortnight, giving diuretics at the same time, when elaterium had only afforded very temporary relief.

Sometimes the dropsical effusion is attended with great debility and hysterical symptoms; and this will admit neither of bleeding nor purging. Here the ferri et potassæ tartras combined with some mild tonic may often be employed with great advantage. The tartarized iron acts slightly, sometimes indeed freely, upon the kidneys, while its tonic powers support the general strength of the system. Occasionally this medicine may be beneficially used after slight bleedings, especially in those cases in which congestion and not inflammation is present.

Some practitioners place very great reliance upon digitalis, and certainly its effects are sometimes quite marvellous. We shall only remark upon it, that no medical man should prescribe digitalis without visiting his patient every day; as from its tendency to accumulate in the system, without this precaution it may often prove fatal.

Organic disease of the uterus, attended by hemorrhage, is occasionally followed by anasarca. The following case will illustrate this form of dropsy.

A married female, thirty-six years of age, suffered, for three years before death, from cauliflower excrescence of the uterus, attended with profuse hemorrhage at intervals. Some time after, she became anasarcous. The effusion continued to increase so long as the hemorrhage recurred. When this ceased, she took large quantities of bark, and generous diet was allowed: the effusion disappeared, and she regained her strength.

[Another cause of anasarca, and of dropsy of the cavities, is the disease of the kidney, described, of late years, as the disease of Bright. In all works on the practice of physic, suppression of urine, or a sudden diminution in the quantity of the secretion, has been esteemed a cause of anasarca; but the researches of modern observers have shown, that a pathological condition of the kidney, in which the cortical portion assumes a granular character, and secretes albumen from the blood, is by no means an uncommon cause. The characters of this renal affection are described elsewhere.

Of partial dropsies, resulting from temporary obstructions of the circulation, a familiar example occurs in intermittents, in almost all cases of which there is more or less enlargement of the spleen, and concomitant infiltration of the cellular membrane; but both affections pass away after the intermittent has been arrested.

On the examination of the subcutaneous cellular tissue of one who has died of anasarca, it is found distended by a limpid serous fluid, usually of a bright orange-yellow hue. In the most common cases of asthenic anasarca, it bathes the cellular tissue and the subjacent muscles, which are rendered unusually pale and flaccid, and tear with the greatest facility. Sometimes the infiltration is confined to the subcutaneous cellular tissue; but at others it extends to that which envelopes the fasciculi and the fibres of muscles, the tendons, vessels and nerves, and occasionally to that which enters into the constitution of the viscera. Wherever the infiltration exists, the cellular membrane is much softened. (Dunglison's *Practice of Medicine*, 2d edit., p. 647 : Philad., 1844.)]

LOCAL ANASARCA.

Anasarca may either generally or locally attend upon organic disease of any part of the body; but it scarcely seems necessary to consider these more particularly. We shall now, therefore, proceed to consider those forms of effusion which are confined to the lower extremities, and in many instances do not even extend above the knee. The first place is due to phlegmacia dolens, which must be regarded as a local anasarca.

The pathology of this disease formed for many years a stumbling-block to medical men; and several very recondite theories were set forth upon the subject. The investigations of Dr. D. Davis, and other pathologists, at length appear, however, to have set this question at rest, and to prove satisfactorily that "the proximate cause of phlegmasia dolens consists in a violent and destructive inflammation of the iliac veins and their contributories, including in some cases the inferior portion of the vena cava."

Dr. Robert Lee has entered more minutely into the pathology of phlegmasia dolens, and has endeavoured to prove that it is connected not only with inflammation of the femoral veins, but of the uterine veins likewise.

Phlegmasia dolens is occasionally also in the male, as in the female subject, in idiopathic disease. A short time ago the writer of this article was called to a man, twenty years of age, a carpenter by trade, who, after an attack of catarrh, was suddenly seized with very extensive œdema of the right leg and thigh. The femoral vein could be distinctly traced, as a firm, hard chord, very tender to the touch, from the groin to its passage through the tendon of the triceps. There were typhoid symptoms present at the same time. The œdema of the limb was very much reduced by the application of leeches, and eventually the man recovered; the treatment after the first few days being chiefly constitutional.

In the treatment of anasarca attendant upon acute inflammation of the veins, our first attention must obviously be paid to the local affection; and the application of leeches in the course of the vessel is a most important point. At the same time resource should be had to purgatives, and more particularly to mercurial purgatives. If by these means we succeed in removing or greatly diminishing the febrile state, we shall still have to combat the disease in its chronic form, for it scarcely ever happens that recovery is at once complete.

If we look to the appearances which the affected vessels exhibit upon examination after death, we find them generally more or less loaded with coagulable lymph, sometimes also accompanied by pus. From what we know of the great irritability of the veins, and the consequences of injecting pus into their cavities, we may well question if recovery be ever possible when suppuration has occurred within them; and it will be therefore the deposition of coagulable lymph only, in the chronic form of the malady, that we shall have to overcome. Analogy teaches us that that kind of inflammation which gives rise to the effusion of plastic lymph is most easily subdued by mercury. It is this which occurs in iritis, which affection is frequently first manifested to the practitioner by the cloudiness induced by the presence of coagulable lymph; and in this disease mercury almost deserves the name of a specific. It is nearly as serviceable in that chronic state which remains after an acute attack of phlegmasia dolens; and we have frequently found the compound calomel pill, given every night for two or three weeks, make a very material improvement in the state of the limb. It may also be advisable, at this period, to combine it with mild tonics. It too often happens, however, that some stiffness and swelling will remain during life, whatever may have been the treatment employed. In the latter stages of the complaint, frictions are very useful.

We have entered on the subject of phlegmasia dolens with the view of rendering the pathology of the various forms of anasarca as complete as possible. For a more ample account of this important subject, we refer the reader to the article PHLEGMASIA DOLENS.

There is also an acute species of anasarca occurring in children, generally about three or four years old, and confined to the legs, seldom extending above the knee. It does not appear usually united with any organic disease, and is generally attendant upon that febrile state to which children of this age are so liable from affections of the primæ viæ. Sometimes it is accompanied with diarrhœa. It commonly disappears under the treatment employed for the cure of the original disease.

Local anasarca occasionally accompanies some cases of amenorrhœa, and varies from mere œdema of the ankle to extensive effusion reaching sometimes as high as the groin. This affection, however, is not always attended with amenorrhœa, but may occur when the catamenial discharge is not manifestly disturbed. The first symptom is swelling and pain about the ankle, more particularly troublesome towards night. In many of these cases, examination of the veins of the extremity will detect tenderness or hardness somewhere in the course of the great veins, and we have seen one instance where the symptoms above enumerated were the only symptoms present. The spot most usually tender is just where the femoral vein passes into the ham, and the affected part often does not exceed more than an inch in length. Frequently also the vein may be felt in this place rolling like a chord under the finger. A lady applied to us in January, who complained of slight pain and swelling at the ankles at night. There did not appear to be any other affection. The general health was good, and the catamenia were regular. There was tenderness and hardness of the femoral vein in the spot alluded to above, but more in the left than in the right thigh, the ankle of which limb was more swelled than the other. Some leeches were applied, which removed both the tenderness and hardness of the veins; and the ankles never swelled after the bleeding. We heard of her a few weeks afterwards, and she had had no return.

The following case, however, affords an example of the most frequent form of the disease, and it is one of many in which the same tenderness of the veins has been exhibited, and which have yielded to the same treatment.

A young lady, aged twenty-two, had long suffered from hysteria and its various complications, *gastrodynia*, flatus, &c., great debility, and depression of spirits. The catamenia were always scanty. Her legs began to swell about the ankles, and the swelling gradually extended to the pelvis. There was considerable tenderness in the course of the femoral veins. Twenty leeches were applied to the affected part, with the effect of diminishing the swelling; but some tenderness in the course of the femoral veins remained, so that leeches were again applied. After this the swelling of the limbs was still further diminished, and there was scarcely any tenderness in the course of the veins. A month afterwards the œdema had nearly disappeared. She remained some time under treatment for dyspeptic symptoms, with which the œdema was combined, but no return of the effusion to any extent was observed. In this, however, as in most of these cases, the ankles continued to swell at night in a greater or less degree, but the œdema did not extend much higher.

It is not always that this kind of effusion can be traced to obstruction in the veins. There are some leucophlegmatic females in whom no local affection can be discovered to account for the œdema, and in whom it seems simply the effect of general debility. In cases of this nature, the mistura ferri composita is frequently very beneficial. The best mode of giving it is in combination with decoction of aloes, or some mild aperient. In all these cases reference must of course be had to the accompanying symptoms. It would be idle to lay down any positive rules for the treatment of the anasarca merely.

There are, doubtless, other forms under which anasarca sometimes appears, besides those which have been now enumerated. Enough has, however, been done to exhibit the principles upon which effusion should always be viewed, that is, not as a disease in itself, but as an evidence of some disturbance in the functions of the animal system, or upon some actual change in the structure of some important organ.

J. DARWALL.

ANGINA PECTORIS. The affection thus commonly designated has attracted great attention since it was first formally noticed by Dr. Heberden, about sixty years ago.[*] The name above prefixed was given to it by the author just mentioned, on account of its "seat, and the sense of strangling and anxiety with which it is attended;" the word angina (from ἄγχω, *strangulo*) having been applied by the ancients to all diseases of the throat accompanied by a feeling of suffocation or strangulation. (Celsus, lib. iv. cap. iv.) The word is still used in this sense by the French, Germans, and other continental nations, comprehending all the inflammatory affections of the fauces, larynx, trachea, and neighbouring parts, classed by Dr. Cullen under the head *Cynanche*. It is evident from the expressions above quoted from Dr. Heberden, that he adopted the name in common use, qualifying its new application by the addition of the word *pectoris*. It is, therefore, incorrectly said by Dr. Frank, that this name has nothing in common with the same word as applied to affections of the throat.[†] This author derives the term from the Latin verb *angere*, taking this in its more general or metaphorical sense, as signifying *to occasion distress*, and apparently forgetting that this word is itself derived from ἄγχω, and, in strictness of language, means the same thing. As the word angina has ceased to be applied, in the medical language of this country, to inflammatory affections of the throat, we shall adopt its use in the present article without always retaining its qualifying adjunct *pectoris*.

Angina can boast of a very copious synonymy. The following are the principal names by which it has been designated by different writers, and the order of their imposition:—

Cardiogmus cordis sinistri	Sauvages,	1763
Angina Pectoris	Heberden,	1768
Die Brustbräune	Elsner,	1780
Diaphragmatic gout	Butter,	1791
Asthma Arthriticum	Schmidt,	1795
Syncope Angens	Parry,	1799
Asthma Dolorificum	Darwin,	1801
Sternodynia Syncopalis	Sluis,	1802
Asthma spastico-arthriticum inconstans	Stoeller,	1803
Suspirium cardiacum	Stephen,	1804
Sternalgia	Baumes,	1806
Stenocardia	Brera,	1810
Pnigophobia	Swediaur,	1812
Angor Pectoris	Frank,	1818
[Neuralgia of the heart	Hope,	1832]

Although the above catalogue does not go farther back than the time of Sauvages, there can be no doubt that the complaint was well known to practical men from the earliest periods of physic; but like several other affections now classed under particular names, and regarded as distinct diseases, it was merely considered as a symptom, or isolated group of the ordinary symptoms, or as an accidental complication or particular phasis of some known disease; and, if noticed at all, passed under the usual name. Before the time of Dr. Heberden, indeed, Sauvages, after Poterius, certainly noticed and named the affection as a separate form of disease; but of this fact Dr. Heberden was ignorant; and his much fuller and more accurate history justly entitles him to the honours of an original observer. Many passages in the writings of the ancients, and particularly in those of Hippocrates, might, without much straining, be made to apply to this disease, notwithstanding the round assertion of the last named author, that "the heart is a dense and solid body, and therefore unsusceptible of pain."* Some have imagined that Aretæus referred to angina under the name of πνευμῶδες; but his account is much less characteristic of the affection than many passages in the writings of Hippocrates. The account which Aretæus gives of the second species of *angina* comes much nearer the disease which we have to describe under the same name. (*Aretæi* Opera, p. 7. Oxon. 1723.) In the works of Cælius Aurelianus, a brief statement occurs in his chapter on paralysis, which has been generally considered, and apparently with reason, as referring to the disease now under consideration.† The case of Seneca, as described by himself, has also been generally considered as a case of angina, and we think most justly. He terms his disease *suspirium*. (*Senecæ* Opera, t. ii. p. 136. Epist liv.) In perusing the medical writings of the sixteenth and seventeenth century, we meet with many observations which can only apply to this disease. These are most commonly found in their account of asthma, with which, as a well-known disease, and as having some of the external symptoms somewhat similar, it was most likely to be confounded. It was with this disease, or at least with dyspnœa, that it was confounded by Poterius and Barteletti, certainly the first medical writers who notice the disease in such terms as cannot be mistaken.‡ In the works of Hoffmann and Morgagni, many well-marked cases of angina will be found.§ One of the earliest, probably, and certainly one of the most unequivocal cases of angina to be found in the English language, is that of the father of the great Lord Clarendon, recorded by his son. In this case the event was fatal.‖

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[*] Some Account of a Disorder of the Breast. Read at the College, July 21, 1768. Medical Trans. vol. ii. p. 59.

[†] Hoc vocabulum nihil commune habet cum eo *angina*, sub quo faucium inflammatio vulgo intelligitur. Prax. Med. Univ. P. ii. vol. viii. p. 244.

After the publication of Dr. Heberden's paper, the disease was noticed by a vast number of medical writers in England, France, Germany, and Italy, both in periodical publications, in the transactions of societies, and in distinct treatises. Since it first attracted attention, angina seems, indeed, to have been a favourite with the profession, and the mere catalogue of the published cases and monographs would fill many pages. The reader who is curious in this matter is referred to the writings of Butter, Parry, Black, Blackall, Elsner, Stoeller, Jahn, Desportes, Jurine, Brera, and Zechinelli. In the work of Zechinelli, in particular, a most ample collection of the recorded facts and opinions respecting this disease will be found; although even his industry has failed to notice a considerable number of important cases scattered through the medical literature of this and other countries. (Sulla Angina di Petto. Padova, 1813.)

History of the Disease. — Angina pectoris is a disease of an intermitting character, in which the patient has intervals of comparative ease or of perfect health, between paroxysms of greater or less suffering. The paroxysm usually makes its first attack while the patient is taking exercise. Whilst walking or running, and more particularly if in the act of ascending an elevation at the same time, he is all at once seized with a most distressing sensation in the chest, usually in the region of the heart, or about the lower half of the sternum and towards the left side. This sensation is variously described, as a pressure, or stricture, or weight; or as a positive pain of various character and degree, sometimes obtuse, sometimes acute,—tearing, burning, or lancinating. There seems always to be something peculiar in the pain, whatever be its degree, unlike the pains of other parts of the body, and as if it were combined with something of a *mental* quality. There is a feeling and a fear of impending death; and the primary symptoms of corporeal disorder are speedily modified by the consequences of mental impressions conveyed through the nervous system.¶ The patient makes a sudden pause, eagerly catches hold of whatever is next him for support, perhaps raises the hand to some object above him to which he clings, or, it may be, imperceptibly sinks down on a chair or bank, as if unable to stand, yet afraid of the movements necessary to seat him. The face is pale, the expression of the countenance haggard, the whole body is covered with a cold sweat, and death appears to be impending no less to the inexperienced spectator than to the miserable patient. Such, in fact, is sometimes the termination of the paroxysm, but rarely, and scarcely ever in the early stage of the disease. After suffering in the way described for a longer or shorter period, varying in different cases from a few minutes to one hour or more, the patient revives, sometimes gradually, sometimes suddenly, and in many cases immediately resumes the feeling and the faculties of health.

The pain is rarely confined to its primary and principal site in the cardiac region, but increases, in different instances, very variously both in direction and extent. It shoots upwards or downwards, or to the right side, and almost always through the left side of the chest towards the shoulder and axilla, and very frequently into the left arm about the middle of the humerus, or as low as the elbow. Sometimes the pain in the last named places is extremely acute; and, frequently, sensations of a similar kind, though less severe, are experienced all along the arm to the fingers, or in both arms, or along the throat and side of the face, and occasionally even in the lower extremities. Generally, these pains in the limbs accompany or succeed that in the chest; sometimes they precede it. In most cases the respiration is unimpeded, although the patient seems at times as if he were unable or afraid to breathe. At other times, and perhaps more generally, deep inspirations are made, and are aided by raising the arms and shoulders, with the view of enlarging the chest as much as possible. Sometimes the breath is retained for a considerable time.

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* Est cor res solida ac densa, et propterea dolore non affligitur. De Morb. lib. iv. cap. x.

† Erasistratus memorat paralyseos genus et *paradoxon* appellat, quo ambulantes repente sistuntur ut ambulare non possint, et tum rursum ambulare sinuntur. *Chron.* lib. ii. c. i. p. 348.

‡ Quædam est respirandi difficultas (says Poterius) quæ per intervalla deambulantibus accidit. In hac fit præceps virium lapsus, propinquis tenentur niti adminiculis, aliàs humi corruerent; hi ut plurimum derepente moriuntur. *Pet. Porter.* Op Om. cum Annot. Hoffmann p. 302. *Francof. ad Mœn.* 1698. Fabricius Barteletti, in his *Methodus in Dyspnœam*, (*Bonon.* 1632) speaks of a variety of this affection, "quæ in ambulationis motu erumpens sola quiete mitescit."

§ A single case selected from the works of each of these authors suffices to prove that they were well acquainted with the disease. See *Hoffmann.* Consult. Med. Cas. 83. Op. t. iv. p. 125. *Morgagni* de Sed. et Caus. Morb. lib. ii. epist. xxvi. art. 31.

‖ Life of Edward, Earl of Clarendon, (dated July, 1668.) Oxford, 1761, vol. i. p. 16.

¶ "Quidni?" exclaims Seneca, reflecting on his own sufferings from this disease, "aliud enim quidquid est ægrotare est, hoc est animam agere." Epist. liv.

The pulse is found to vary considerably in different cases. Sometimes it is regular, sometimes irregular; in one patient frequent, in another slow; sometimes feeble, sometimes strong, and occasionally altogether suppressed; most commonly, perhaps, it is regular, small, and weak. Eructations of flatus are almost always present, and when present generally afford relief. Frequently, indeed, in the less severe cases, the paroxysms seem to give way immediately upon the supervention of the discharge; and the same result *occasionally* follows, but much less commonly, a *similar* discharge downwards. In the commencement of angina, the attacks are, in general, *comparatively* mild; and commonly increase *progressively* in severity as well as frequency, as the disorder is prolonged. In a certain proportion of cases, the symptoms are so mild as to give rise to doubts whether the affection is really angina; the whole paroxysm often consisting of an instantaneous pang in the situation of the heart, passing off nearly as soon as felt. In others, the pain is of longer duration, and is accompanied by more or fewer of the irradiations to remote parts which mark the severer paroxysms,—in particular, the pain of the left arm. In a third class of cases, the patient is suddenly invaded by an indistinct, very distressing, but not very painful oppression in the region of the heart. He is agitated and alarmed; his sensations are distressing, his apprehensions are more so. He feels as if the heart were violently compressed; or as if it were distended and about to burst, or as if its movements were suddenly arrested. This last sensation is the most common. In every variety of paroxysm, whether slight or severe, palpitation of the heart is not an unusual occurrence. Sometimes it precedes, sometimes accompanies, sometimes follows the painful sensation; but in many of the severest and best marked cases it is entirely wanting.

Angina occurs in both sexes, and at all ages above that of mere childhood; but it is much more common at particular periods of life; and the severer cases, at least, are met with much more frequently in the male sex. Of eighty-eight cases related by different authors, and to which we have referred with a view to this particular question of sex, only eight occurred in females, being exactly one-eleventh of the whole; and of the total number of patients, twelve only were under fifty years of age. Were we, then, to be guided solely by the published cases, we should say that the common opinion, which represents the disease as especially affecting the male sex and persons advanced in life, is most just. No doubt it is so; but still it is necessary to make some allowance for circumstances connected with these recorded cases, before they can be received as grounds for fixing the statistics of the disease, taken without reference to its degree of severity. The truth seems to be, that of the more severe cases, particularly such as depend on organic disease of the heart and large vessels, the great majority occur in the male sex; while of milder cases, a very considerable proportion, perhaps an equal proportion, are met with in females, and at an earlier period of life. This, at least, is the result of our own experience; and the same opinion is entertained by writers of great authority.[*] The same conclusions as to the greater frequency of mild cases in the female sex, and at an earlier age, are supported by certain other results of the published histories of angina. Thus, while only one-eighth of the males recovered, no less than one-half of the females did so, viz., four out of eight; and of these four, only one was above fifty years of age. But it is to be further recollected that the greater mildness and curability of the disease in women will partly account for the very small proportion of this sex among the published cases. The very severe cases naturally attract more attention, more particularly if, as often happens, they have been terminated by a sudden death, and followed by a dissection; and these are the cases that are usually recorded and published; while others of precisely the same nature, but differing in degree, are too often overlooked or even forgotten. From these considerations, therefore, and from our own observations, corroborated by those of Jahn, Hosack, Laennec, &c., we are disposed to believe, that while among the severe examples of the disease, the proportion of males to females may be even greater than is commonly believed; among the milder cases, there may be found as many women as men.

There is no situation in life peculiarly exempt from this disease; but it attacks some classes of persons much more than others. Like many other diseases, angina is the attendant rather of ease and luxury than of temperance and labour; on which account, although occurring among the poor, it is more frequently met with among the rich, or in persons of easy circumstances. This fact alone shows that its attacks are much more influenced by adventitious circumstances than by natural temperament. The same remark applies to the reported prevalence of the disease in particular seasons, and in what has been termed particular medical constitutions. (*Laennec*, De l'Auscult. Méd.) It must, however, be admitted that the greater number of cases depend on causes of too fixed and too formidable a quality to be modified by circumstances of this kind.

Although by no means of rare occurrence, angina cannot be said to be a common disease, more particularly in its strongly marked form. In the numerous instances of organic disease of the heart constantly met with in practice, symptoms which may be termed irregular angina, namely, more or less of pain or uneasiness in the region of the heart, suddenly coming on during exercise, and obliging the patient to stand still for a short time, are complained of, in almost every case, in a greater or less degree; but the severe affection described by Dr. Heberden and his followers, and of which an outline has been given in the beginning of this

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[*] *Jahn*, Ueber die Syncope Anginosa Parry. Hufeland's N. Journ. 1806.

article, is certainly not of frequent occurrence. It is proper to observe, however, that the great improvements which have taken place of late years in pathology, by enabling practitioners to connect symptoms with their organic causes more accurately, have necessarily diverted the attention from the artificial combinations of the old nosology; and as the knowledge of cardiac affections has, moreover, been particularly increased by the discovery of a very superior instrument of diagnosis, it is probable that many cases which the older authors would have referred to angina, have of late years been looked upon and recorded simply as diseases of the heart. If only the well-marked cases are taken, it will be found that the whole number recorded in the works of our English writers since the time of Heberden, as well as in those of the best authorities in France, Italy and Germany, does not much exceed one hundred.

If we were to form our opinion solely from the results of the published cases of angina, we should say that it was one of the most dangerous and fatal of diseases. For instance, in a list of sixty-four cases now before us, of which the result is recorded, no less than forty-nine proved fatal, almost all suddenly; while of the remaining fifteen the greater proportion are recorded as relieved only. But we are by no means disposed to receive such results as coming at all near the truth, as regards the disease generally. Most of the cases in the above list were examples of organic disease of the heart or large vessels; and if we were to limit our views to this class of cases, the proportion of deaths above stated is probably less than the truth. But we shall find that a very large class of cases, legitimately ranged under the head of angina, have no necessary dependence on structural lesion of the heart; and of these the general result will be found very different from that recorded above. It is from having overlooked this last class of cases, that most of the earlier writers on angina considered it as almost inevitably fatal; and it is, perhaps, from giving too exclusive an attention to the milder forms of the affection, that some other authors have taken a view of it perhaps as much too favourable as the others did the reverse. Of the latter class of writers, Laennec, Hosack, and Butter are the principal. Laennec considered the disease as extremely common in its milder forms, and did not regard it, in general, as a severe disease. (Loc. Cit.) Dr. Hosack believes the severity of the affection to have been much exaggerated, and looks upon it as very much under the influence of medical treatment.* Dr. Butter, who considered angina to be a species of irregular gout, says that he must "impute the chief, if not the sole, difficulty of curing the disease to the want of conformity of the patient himself with regard to diet."†

The following synoptical view of some of the statistical details relating to angina will be found convenient for reference, and is, therefore, subjoined, although in some respects a repetition of what has gone before.

A. *Results relative to the sex of the patients.*

Total number of cases examined,		88
Of these were, men	80	
women	8	

B. *Results relative to the age of the patients.*

Total number whose ages are recorded,		84
Of these were, above fifty	72	
under fifty	12	

C. *Results relative to the event of the cases generally.*

Total number of patients, the event of whose cases is recorded,		64
Of these there died (almost all suddenly)	49	
Were relieved or recovered	15	

D. *Results relative to the event of the cases as regards sex.*

1. Total number of fatal cases		49
Of these were, men	47	
women	2	
2. Total number of cases cured or relieved,		15
Of these were, men	11	
women	4	

Causes.—Under this head, we shall at present notice only the exciting causes of the paroxysms. The remote and predisposing causes will be considered with more practical advantage, athough with less logical catenation, when we come to treat of the different varieties of the disease, and the means of preventing and curing it.

The exciting causes of the paroxysms of angina, or the circumstances under which they occur, are, in general, so well marked, and so constant and uniform, that they might almost have been included in the description of the disease. They may be stated in general terms, to be all such as accelerate the flow of blood, or suddenly increase the action of the heart. The principal of these circumstances are all kinds of bodily exercise, as in walking, running, straining, &c., and the more powerful emotions of the mind. Of all the movements of progression, that of going up stairs or up hill is by far the most effective in inducing a paroxysm; and it has been frequently remarked that, *ceteribus paribus*, walking against the wind is considerably more injurious than walking in a contrary direction. Sometimes even walking in the open air in perfectly calm weather has induced a fit, when the same degree of exercise within doors has had no such effect. (Medical and Physical Journal, vi., p. 320.) In some rare instances, the first paroxysm has been induced suddenly during powerful bodily exertion, as in leaping, raising a weight, &c.;‡ and in such cases, it has been found that a slight rupture has taken place in the valves of the heart or their appendages. In the earlier stages of a severe disease, and through the whole course of mild cases, the attacks are commonly induced by the more powerful of the causes mentioned, or by others of an analogous kind; but as the disease increases in severity, the slighter causes of the same kind suffice to excite a paroxysm. Thus, in some unhappy individuals, almost any general bodily movement, such as the act of turning in bed, or walking across the room, or coughing, sneezing, or relieving the bowels, or even thinking intensely, will occasion a seizure In subjects of such extreme susceptibility, paroxysms will, of course, frequently occur without any very obvious cause. Any of the causes being applied immediately after a meal, acts with much greater certainty and force; and sometimes the mere presence of a full meal in the stomach seems sufficient to excite a paroxysm. In certain cases, the attacks occur most frequently at night, on the patient awaking from sleep, as is so frequently the case with paroxysms of asthma; and this circumstance is one of several which have led some writers to consider angina as allied to that disease.

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* Essays on various Subjects of Med. Sci., vol. ii. 288.

† Treatise on Angina Pectoris, 2d edition p. 24.

‡ *Black* in Mem. of Med. Society of London, iv., p. 61. *Blackall* on Dropsy, 2d edition, p. 381.

Pathology of Angina.—In a perfect system of philosophical medicine, founded on the basis of the pathological condition of the organs primarily affected, angina, such as we have described it in the preceding pages, would be banished from the list of individual diseases; since it cannot be denied that the various phenomena which constitute the paroxysm may be present in different states of the system, or may even originate, as far as we know, in different states of the very organ in which we believe them to have their site. In such a system, it could only be regarded as a group of symptoms—frequently found co-existing, it might be—but still merely the incidental attendants of different diseases. But as it is impossible, in the imperfect state of our actual knowledge, to say, in the case of angina, as in that of so many other diseases, what morbid phenomena are essential, and what merely contingent, we shall attempt no such refinement on the present occasion, but following the steps of our numerous predecessors, shall treat of angina as a distinct disease.

In common language, the term angina pectoris is frequently restricted to the more prominent phenomena of the paroxysm, as above described; and there can be no harm in so applying it, provided its restricted meaning is not misunderstood. But when the disease angina is regarded in the comprehensive point of view which can alone lead to important practical results, it is very far from being confined to the limits of the paroxysm. On the contrary, it must be considered as comprehending all the derangements of the system, general and local, which precede, accompany, or follow the paroxysm, or which can in any way be regarded as influencing it. This is the notion of the disease which exists in the mind of every experienced practitioner; and this is the sense in which the word angina is generally to be understood in the present article, although it will be observed that we have already been using it in its more restricted meaning.

Seat and nature of the disease.—Numerous considerations prove that the pain in the paroxysm of angina has its primary and principal seat in the heart or annexed great vessels. 1. The patients almost always refer their agony to the region of the heart; the more distant pains of the shoulder, arm, &c., appearing to spring from this primary source, and being, in almost every case, subsequent to the invasion of the paroxysm.* 2. The peculiar character of the patient's sufferings, partly physical, partly mental, the anxiety, dread, &c., are such as could only be produced by the affection of an organ like the heart, on whose action life so immediately depends, and whose disturbance is so instantly perceived by the sensorium. 3. The exciting causes of the paroxysm are always such as are especially calculated to disturb the natural action of the heart; namely, bodily exertion, emotion of mind, compression of the heart by the encroachment of other organs, &c. 4. The frequently fatal termination of this disease, and the suddenness of the death, are only to be explained by disorder of the heart or great vessels, as the affection of no other organ in the chest or abdomen could produce such a result. 5. But all these presumptive proofs, if we may so term them, are corroborated, and, indeed, confirmed, by the physical condition of the heart itself, ascertained by dissection in fatal cases, and by the stethoscope during the life of the patients. In a vast majority of the fatal cases of angina of which dissections are recorded, there has been found great structural disease in the heart, or aorta, or both. In these cases, there can scarcely be a doubt entertained that the pain was seated in the heart or great vessels; and as the character of the pain and other symptoms in cases in which no organic lesion is recorded, have been observed to be precisely similar to those occurring in the former, it would seem unjustifiable scepticism to disbelieve that both had the same site. There seems nothing improbable, much less impossible, in a heart altogether of healthy structure becoming the site of such a pain; but there is reason to believe that, in the few cases of fatal angina in which no organic lesion was found on dissection, the heart was not exactly of just proportions or of perfectly sound structure. We found this opinion partly upon the published accounts of those dissections, and partly on our own observations both on the dead and living subject. It is easy to overlook slight misproportions in the different cavities, and also various morbid conditions of the muscular fibre of the heart, which may have sufficed, nevertheless, to occasion the greatest distress or disorder in the action of the organ. And in many cases of the milder forms of angina, we have been enabled to ascertain during life, by means of auscultation, that the heart was not exactly of healthy proportions, either in relation to its own parts individually, or to the system generally.

With the view of more fully corroborating the accuracy of these statements and opinions respecting the seat of pain in the paroxysm, we subjoin a brief outline of the results obtained on dissection, in some of the principal cases recorded by authors since the time of Dr. Heberden.

A. *Results relative to the existence of organic disease in general.*

Total number of cases of which dissections are given	45
Of this number there was no organic disease (except obesity) in	4
——— Organic disease of the liver only, in	2
——— Organic disease of the heart or great vessels, in	39

B. *Results relative to the nature of the organic affections of the heart and great vessels.*

Total number of cases in which there was organic disease in the heart or vessels	39
Of this number there was organic disease of the heart alone, in	10
——— Organic disease of the aorta alone, in	3
——— Organic disease of the coronary arteries alone, in	1
——— Ossification or cartilaginous degeneration of the coronary arteries, in	16
——— Ossification or other disease of the valves, in	16

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* In a few cases the pain has been found to commence in the arm, and dart from this to the breast. But we believe this has always been in cases of long standing. We are aware of no case of *recent* origin in which such an occurrence has been observed. And this distinction is important.

——— Disease of the aorta (ossification, or dilatation, or both), in 24
——— Preternatural softness of the heart,* in 12

If we consider it as proved, by the foregoing statements, that the heart and its great vessels constitute the seat of the pain and all the principal phenomena of the paroxysm of angina, it still remains to be inquired what is the nature of this pain, and what are its immediate causes, or the circumstances on which it immediately depends. And there seems no great difficulty in coming to a satisfactory conclusion in this matter, if we keep in view; 1. the facts recorded relative to the frequency of structural disease in the heart and aorta in angina; 2. the characters of the pain itself, its instantaneous invasion and cessation, its violence, its short duration, and its complete disappearance for long periods of time; 3. the nature of the actions of the heart and great vessels in health; and, lastly, the nature and causes of painful affections in other parts of the body.

We have no doubt that the pain, and other principal phenomena characterising the paroxysm of angina, may acknowledge different causes and depend on different conditions of the affected parts, in different individuals, and in the same individual at different times; just as we find in other parts of the body, more particularly in parts possessing a structure and functions somewhat analogous to those of the heart; namely, the hollow viscera possessing muscular tunics, and destined to convey fluids. The stomach, the intestines, the bladder, the gall-ducts, ureters, &c., are all subject to sudden paroxysms of severe pain, frequently originating in very different causes, yet very similar in their external character. In the stomach or bowels, for example, we may have gastralgia or enteralgia, of the same general appearance, from pure muscular spasm; from matter irritating the internal membrane; from simple neuralgia, the source of irritation being at the origin of the nerves; from over-distension, &c. &c.; and each of these may exist with various organic diseases of the part, or without any organic disease; and two or more of them may co-exist. It is reasonable to suppose that painful affections of this kind will much more easily be produced in a diseased organ than in a sound one; and, indeed, experience proves, that although almost all organs are liable to severe pains, from some unknown temporary condition of the nerves themselves, usually termed neuralgia; yet that they are much more liable to such painful affections when diseased in their structure, and consequently disordered in their action or enfeebled in their powers. From what has been already stated of the frequency of structural disease of the heart and aorta necessarily disordering their action, it will readily be understood how easily pain may be induced in these parts under various circumstances, and from many different causes; and it seems equally intelligible how similar pains may originate in the same parts, under particular circumstances, even when no structural lesion exists in them. In this, as in so many other cases, authors have frequently failed in accounting for the phenomena, because they took too confined a view of the subject, and were anxious to establish a greater simplicity in the production of the symptoms than nature acknowledges.

Of the intimate nature of the pain in the paroxysm of angina we know nothing; but we know no more of the nature of any pain. All that we can propound concerning it is a relation of the events which seem to lead to it, and the condition of the parts in which it occurs, at the time of its occurrence. We know that the pain is not of that kind which arises from inflammation, or ulceration, or any other fixed physical alteration of a part. All the circumstances attending it prove it to be of that kind which occurs in cramp or spasm, or from pressure, or in the class of cases termed neuralgic, in which the painful sensation is the result of some unknown temporary condition of the nerves of the part, not manifested by any physical alteration of them discoverable by our senses. We have sufficient evidence that such a morbid condition of the nerves may be produced in a heart in all other respects sound; and when it takes place in a heart manifestly diseased in its structure, we must consider the structural lesions merely as predisposing and exciting causes of the pain. That the structural lesions are not the immediate and necessary source of the pain is sufficiently proved by its intermitting character, and the perfect ease in the intervals, when the structural lesion is precisely the same as during the paroxysm. The anatomical structure, the peculiar action and functions of the heart and annexed great vessels, will sufficiently explain all the modifications of the pain and other phenomena observed in the anginous paroxysm. The radiation of the pain to a distance from the primary and principal site of it is only in conformity with what is observed in all other painful affections. Stone in the bladder produces pain in the glans penis; calculus in the ureter, pain in the abdominal walls; inflammation of the cartilages of the hip-joint, pain in the knee; and what is perhaps a still more appropriate illustration, irritation at the origin of nerves in general frequently manifests itself only by pain at their extremities. In a word, the pain, in the paroxysm of angina, may arise from neuralgia, from spasm, from over-distension; and the other principal phenomena, may all, we think, be explained by the derangements of the functions of the heart, considered as a muscular organ charged with the office of circulating the mass of blood.

Varieties of Angina.—Under this head we do not mean to notice the different forms of the paroxysm as witnessed in different cases. Such distinctions are of little practical value. We wish here to advert to the different circumstances, whether of a local or general kind, under which the paroxysms take place, and which may materially influence both the prognosis and the treatment. Some of the most remarkable of these differences have reference to the physical condition of the parts immediately affected in the paroxysm; others to the state of the general system with which the local affection is connected. We shall briefly notice the chief of these varieties in the order now stated.

In one class of cases there exists great structural disease of the heart and aorta; in another class there exists either no structural disease, or none that can be detected. The former class of cases may therefore be termed organic angina; the latter, functional angina. Each of these classes may be subdivided according as the affection of the heart and aorta exists uncomplicated with other diseases of a general or local kind, or coexists with some such disease or diseases on which it is more or less dependent. This classification would give the following arrangement:—

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* In a great many cases the consistence of the heart is not noticed.

I. *Organic angina.*
1. Pure, or idiopathic.
2. Complex, or sympathetic.
II. *Functional angina.*
1. Pure, or idiopathic.
2. Complex, or sympathetic.

1. The cases that come under the first subdivision of organic angina are few in number. They are those in which the anginous paroxysms seem to be the direct consequence of organic disease of the heart occurring in persons otherwise healthy. Cases of this kind are seldom very well marked, the anginous symptoms being either feebly manifested, or overpowered by the greater intensity of the more ordinary symptoms of heart disease. These may be considered, in one respect, as the worst cases of angina, inasmuch as they held out little prospect of cure or even of alleviation. Our influence over diseases of the heart is very slight, except they are partly the effect of some other disorder of a more curable kind.

2. Under the next subdivision of organic angina, we would include the greater number of the best marked and more severe cases of this disease. In these, along with the organic affection of the heart or vessels, or both, (probably not very great, or, at least, marked rather by the paroxysm of angina than by the general symptoms of diseased heart,) we have some obvious general disorder of the system. In cases of this kind, the organic disease of the heart and aorta seems often to be a consequence of the co-existing disorder; if not a consequence, it is always greatly aggravated by its presence; and hence the most successful medical treatment of the angina is that which has direct reference to the concomitant disorder.

Among the various structural affections formerly detailed as constituting the essential or organic character of these two classes of cases, different authors, at different times, have been anxious to select some one lesion as the exclusive cause of the disease. The principal of these have been,—ossification of the coronary arteries, ossification and dilatation of the aorta, accumulation of fat in or around the heart, &c. To these may be added, with equal propriety, several other morbid states of the heart, particularly—softening of the muscular substance of the heart, dilatation of one or more of the cavities, &c. It will be at once admitted as a necessary consequence of the result of the dissections given above, that no one of these lesions is entitled to be considered as exclusively the cause of the paroxysm of angina; and that some of those which have been most generally believed to be such, are equalled or exceeded in point of frequency by others. Thus we see that the ossification of the coronary arteries, formerly considered by so many as the chief or sole cause of the paroxysm, is only of the same frequency of occurrence as disease of the valves, while disease of the aorta is much more frequent than either. But we think it probable that much slighter deviations from the normal condition of the organs of circulation than any above noticed constitute quite as frequent causes of this disease; more particularly of the milder cases. In a certain proportion of this class of cases it is not always possible to detect, during life, the existence of any organic lesion, much less the precise lesion; and from the same cause, (its slightness,) it is frequently overlooked in the examination after death. In a considerable number of such cases, however, the nature of the morbid deviation is discoverable both during life and after death. The most common of these slighter deviations from healthy structure are, a thin and slightly dilated state of the ventricles, and a want of tone in the muscular fibre.

3. We consider cases of the kind just mentioned, in which the organic deviation is so slight as to be hardly discoverable, as constituting the greater number of those usually viewed by practitioners as examples of pure functional or nervous angina. It is obvious that in extreme strictness of language they are not entitled to this name; yet if the deviation is only so slight as to constitute mere feebleness, (and it is often nothing more,) they are probably as well entitled to the name as most other diseases commonly denominated nervous. But it must be admitted that in persons possessing the best-proportioned hearts, and in which no deviation whatever from the normal structure can be detected either during life or after death, there may and do occur paroxysms of angina. The proportion of such cases is however very small under any circumstances in a state of uncomplication with other diseases; and we look upon them rather as of possible occurrence than as having certainly met with them in practice. Conjoined, however, with some other disorder, as in the next class of cases, we conceive they are by no means rare.

4. Under the head of complex or sympathetic functional angina, we must comprehend a large class of cases; and, for the reasons stated in the last paragraph, although not strictly philosophical, we would, for practical purposes, include under the present division all the cases of nervous angina complicated with other diseases, whether the organs of the circulation are perfectly sound and well proportioned, or only deviating in a very slight degree from this state of integrity. Under this head are comprehended a very considerable proportion of the cases met with in practice, and not a few of those which present symptoms of the greatest severity in the paroxysm.

The limits of this article prevent us from entering into any lengthened details respecting the morbid states, general or local, which complicate angina, whether as simple coincidents or as predisposing causes. It is highly necessary, however, that the attention of the practitioner should be particularly called to them, since, as has been already observed, almost all our remedial measures must be directed rather against these complications than against the local affection which gives the disease its name and character.

Of these complications, there is none more made, regard acute anasarca as an inflammatory disease. This, however, is not always the case. The following extract from Dr. Bateman's Reports of the Diseases of London, shows that it may be the result of a debilitating cause, and require a tonic treatment. "The patient was a middle-aged woman, in previous health. She was thrown into a state of extreme fright and alarm, on discovering in the evening that she had lost her little store of money, the savings of several years, and the next morning she was anasarcous from head to foot. By tonics, combined with diuretics, the disease was speedily removed."

The last modification of anasarca to which we shall advert is that in which its pathology is very obscure, viz., when the effusion is connected with disordered states of menstruation. Dr. Abercrombie affirms that such modifications of dropsy have been too indiscriminately classed among the cachectic diseases, and referred to a debilitated state of the system.

Sauvages relates the case of a young woman who became suddenly dropsical over the whole body a few days before the menstrual period; when the menstrual discharge took place, the dropsical swelling disappeared. The swelling returned at the same time and disappeared in the same manner for several successive periods, till at length, by a course of treatment which he describes, it was prevented from taking place.—Sauvages Nos. Meth. vol. ii. p. 471.

Hoffmann describes the case of a woman, thirty years of age, previously strong and healthy, in whom the menstrual discharge was in general remarkably copious. Having suffered from a fright immediately before the menstrual period, the discharge did not take place, and she was seized with languor, loss of appetite, and dropsical swelling to such a degree that the integuments on the feet burst and discharged serum in great quantity. The menstrual discharge having taken place at the next period, all these complaints were removed.—Hoff. Med. Rat. (*de Hydrope.*)

Similar symptoms have been occasionally observed in connexion with suppression of hemorrhoidal discharge after it has become habitual.

Dr. Abercrombie adds, these cases certainly indicate a state of the system very different from that which we understand by the term cachexia. Such affections are usually treated upon the plan of merely evacuating the effused fluid. It forms an interesting subject of investigation whether they would not admit of much more active treatment.

A similar affection occasionally supervenes in females about the period of the cessation of the catamenia. The anasarca comes on slowly and insidiously, and is in general best treated by small bleedings and purgatives, with restricted diet, and confinement to the horizontal posture.

Excessive menorrhagia is not unfrequently followed by anasarca. It occasionally occurs in young females when the menstrual secretion is profuse. In these cases a considerable quantity of coagulated blood flows from the uterine vessels for the first two or three days of the menstrual period. Slight effusion in the lower extremities, and sometimes on the whole body, takes place, with considerable weakness. Such cases are very little under the control of treatment, unless the hemorrhagic action, on which the effusion depends, be checked.

[Few topical applications are of much benefit. The laced stocking, or any ordinary bandage, has been advised to aid absorption, and to afford support. When the integument becomes inflamed, as it often does in cases of great distension, washes of subacetate of lead, or weak creasote water, may be prescribed along with the gentle support of the bandage; but in most cases a warm, soft poultice will prove more serviceable. When there is apprehension of spontaneous rupture of the integument, it may be advisable to evacuate the fluid by punctures with the point of a lancet. Where the vitality of the parts has been greatly depressed by the protracted pressure of the fluid, gangrenous inflammation sometimes attacks them. To guard against this, the punctures ought not to be too numerous or too close together. As the fluid is discharged, a gentle and equable pressure should be made, by means of a bandage, on the distended integument. The operation of acupuncture has been used advantageously to drain off the fluid. In such cases, larger needles than those in common use are needed. Some prefer them of the size of an ordinary glover's needle, and of a triangular shape,—a puncture of this kind being less likely to close. (*Practice of Medicine*, p. 651.)]

ANASARCA FROM ORGANIC DISEASE.

Anasarca is also a common consequence of several organic diseases, and its treatment admits of some modification according to the organ originally affected.

In all chronic diseases of the heart, if the patient is not carried off suddenly, anasarca ensues towards the termination of life. It usually begins in the face, and the first symptom perceived is the swelled or puffed state of the eye-lids on rising in the morning. To this in a short time succeeds anasarca of the lower extremities, gradually extending upwards, and at length involving every part of the body. Hydrops pericardii and hydrothorax are also usually present.

[The most common cause of dropsical infiltration unquestionably is, an impediment to the circulation of the blood, either in the great central organ, or in some portion of the venous system. Very frequently this impediment to the circulation in the heart appears to consist in a morbid condition of the valves, which, owing often to dilatation of the cavities of the heart, become insufficient to close the openings, and, consequently, seriously disturb the circulation of the blood through that organ. This insufficiency, as a cause of dropsy, would appear to exist most frequently in the tricuspid valve.]

The treatment of anasarca dependent upon disease of the heart must be very much guided by the general symptoms which may be present at the same time; for it must be remembered that the obstruction to the flow of blood through the heart is very apt to produce congestion and even inflammation of the lungs. If this be present, therefore, an antiphlogistic treatment must of course be adopted. But it may also be the result of mere debility, and the principal inconvenience may result from the effusion itself. The latter state chiefly occurs in very old cases; the former is common when chronic disease of the heart occurs in young persons, and of an irritable temperament.

The following case exhibits the appearances which are frequently found in young persons, and affords a strong illustration of the proper mode of treatment.

A young man, only thirty-two years of age, had suffered for two years from disease of the heart. A fortnight before his death, his lower extremities became œdematous; he was attacked with violent palpitations, dyspnœa, and hæmoptysis. He was bled, and the usual remedies were resorted to; but the attacks of palpitation continued to increase in violence, the effusion increased, and he died on the fourteenth day from his first confinement to the house. On dissection the lungs were found externally healthy, but generally œdematous and gorged with blood; and the inferior lobe of the right lung was completely hepatized. The heart was enormous, but principally from distension of the right cavities. Their parietes were thinned, and they were at least double their usual capacity. The left cavities also were larger than usual, and the mitral and semilunar valves were in a semiosseous state. Both passages were greatly narrowed.

The above case is sufficient to show that sometimes bleeding may be necessary in anasarca arising from disease of the heart; but this is not the place to pursue farther the appearances in hydrothorax with which the external effusion is usually united. They will more properly appear under that head.

With regard, then, to the treatment of anasarca depending upon disease of the heart, we have first to consider its character. If inflammatory, or even attended with much congestion, bleeding will be very necessary; in other cases, and where the principal inconvenience arises from the effusion, we shall derive the best assistance from purgatives and digitalis. In all these cases, however, we can only regard these medicines as capable of affording relief: the anasarca will unquestionably return repeatedly, unless the original disease can be removed.

Of the purgatives which are recommended for the removal of anasarca, elaterium appears to deserve the preference. As a hydragogue, indeed, it is not excelled. The formula which we have always employed, is that described by Dr. A. T. Thomson, viz. ss. gr. of extract of elaterium, with five grains of extract of gentian, given every hour till watery evacuations are procured; and so successful has it proved, that we have never been tempted to change the combination. In giving this very powerful medicine, however, considerable care ought to be taken that it be not continued too long. In one instance, where, from the great relief which the patient had derived the preceding time that he had taken it, he continued it much longer than he was ordered, most violent hypercatharsis ensued, and he became for a short time completely maniacal. The delirium went off after a few hours, and so successfully had the elaterium emptied him, that a much longer period than usual elapsed before the effusion became again inconvenient.

In order to be of much service, the elaterium should be repeated every two or three days for a fortnight, when it may generally be suspended for a short time. Occasionally given in this manner, the dropsical effusion disappears for several months, until it is again excited by cold or some accidental aggravation of the disease of the heart.

Another remedy which of late years has been much recommended, is the croton oil: the chief objection to it is its uncertainty. Upon some individuals a single drop acts very violently, while upon others it appears to be perfectly inert. We have given as many as five drops to one patient, of the same preparation which caused upwards of thirty large watery evacuations in another patient who took only a single drop. When it does, however, agree with the constitution, it is in some respects preferable to elaterium, as the patients sooner overcome its debilitating effects.

It often happens that with disease of the heart some disease of the liver is combined; and here mercurial purgatives, joined with diuretics, are frequently very useful During the last year we succeeded in removing the dropsical effusion by a powder of calomel and jalap every morning for a fortnight, giving diuretics at the same time, when elaterium had only afforded very temporary relief.

Sometimes the dropsical effusion is attended with great debility and hysterical symptoms; and this will admit neither of bleeding nor purging. Here the ferri et potassæ tartras combined with some mild tonic may often be employed with great advantage. The tartarized iron acts slightly, sometimes indeed freely, upon the kidneys, while its tonic powers support the general strength of the system. Occasionally this medicine may be beneficially used after slight bleedings, especially in those cases in which congestion and not inflammation is present.

Some practitioners place very great reliance upon digitalis, and certainly its effects are sometimes quite marvellous. We shall only remark upon it, that no medical man should prescribe digitalis without visiting his patient every day; as from its tendency to accumulate in the system, without this precaution it may often prove fatal.

Organic disease of the uterus, attended by hemorrhage, is occasionally followed by anasarca. The following case will illustrate this form of dropsy.

A married female, thirty-six years of age, suffered, for three years before death, from cauliflower excrescence of the uterus, attended with profuse hemorrhage at intervals. Some time after, she became anasarcous. The effusion continued to increase so long as the hemorrhage recurred. When this ceased, she took large quantities of bark, and generous diet was allowed: the effusion disappeared, and she regained her strength.

[Another cause of anasarca, and of dropsy of the cavities, is the disease of the kidney, described, of late years, as the disease of Bright. In all works on the practice of physic, suppression of urine, or a sudden diminution in the quantity of the secretion, has been esteemed a cause of anasarca; but the researches of modern observers have shown, that a pathological condition of the kidney, in which the cortical portion assumes a granular character, and secretes albumen from the blood, is by no means an uncommon cause. The particularly indicated in dyspeptic complications, and where there exist signs of distension of the stomach by flatus.

This circumstance of the stomach being so generally oppressed with flatus during paroxysms of angina, and of the expulsion of this being almost always the harbinger of relief, if not its cause, is a remarkable feature in the history of the disease. In reading the numerous cases recorded, one is struck with the frequent mention of this circumstance; and our own experience entirely corroborates the observations made by others, that it is by no means rare in subjects who are altogether free from any signs of indigestion in the intervals of the paroxysms. From this and other considerations, there seems little reason to doubt that the gas is formed in the intestinal canal during, or immediately before, the paroxysms. Be this as it may, there can be no doubt that its expulsion during these, forms, in most cases at least, a rational indication of treatment; since, whether a cause or consequence of the paroxysm, its expulsion almost invariably gives relief:[*] and it is sometimes found that the simple aromatic waters are more effectual in producing this result, than medicines usually considered of greater power.[†]

A very different mode of relief, already noticed, namely, venesection, has been occasionally employed with much advantage; and there is great reason for believing, that, if more judiciously applied, it would have been still more beneficial. Several different circumstances met with in paroxysms of angina, sometimes separately, sometimes conjointly, seem fully to justify the trial of this remedy, even if its use had not been vindicated by experience. These are, the state of general plethora, so frequently found in such patients; the state of actual local plethora or morbid accumulation of blood in the heart and large vessels; the state of relative local plethora of the same parts from feebleness of the organ in propelling its contents. In all these cases the diminution of the mass of blood, if it can be effected without immediate risk of life, would unquestionably be beneficial; and the practice of several eminent men has proved it to be often safe. Dr. Percival, Dr. Parry, Dr. Hosack, Mr. Allan Burns, and several others, are of this number. We have ourselves employed it with benefit in some strongly marked cases of angina; and the instantaneous and signal relief which every physician must have often observed from venesection in organic diseases of the heart, leaves no doubt of its usefulness in this disease, when employed with discrimination, and with the necessary precautions. These precautions are well stated by Dr. Parry in his Inquiry, in the following terms: "The patient should be placed in the horizontal posture, and blood should be taken away from a very small orifice, while, at the same time, the finger of the physician is applied to the pulse, in order to decide on the propriety of continuing or discontinuing the flow of blood. If no person of adequate judgment is at hand, it may be right to restrict the quantity of blood taken away to about three ounces at any one operation." (On Syncope Anginosa, p. 164.) We have already stated, that where this measure is deemed advisable, it ought to take precedence of the administration of cordials, which are much more likely to act beneficially after the heart has been partially freed from the load which was oppressing it: and such remedies will, in most cases, be very properly administered after detraction of blood.[‡]

As the affusion of cold water in the paroxysm of angina has been mentioned as a remedy by some authors, we notice it here chiefly with the view of entering a caution against its employment. It can rarely be employed with benefit or even safety. The partial application of cold water, however, may be sometimes admissible as a stimulant of the nervous system, just as we apply it in hysteria. A curious case of severe angina is related by Joseph Frank, in which the patient, a medical man, found singular relief from the application of cold water to the head; and the relief was more speedy, if, during the application of the water, the left hand was placed, in a particular manner, on the head. The same author relates a case in which the impending paroxysms seem to have been averted by the cold affusion; but, as already stated, we cannot consider such a practice as generally safe.[§]

[Laënnec affirmed, that the remedy which most frequently succeeded with him in procuring alleviation, in cases of angina pectoris, and of neuralgia of the heart of a slighter kind, and without radiating pain, was the magnet; which he employed in the following manner: two steel plates, strongly magnetized, of an oval form, and slightly arched, so as to admit of close application to the parietes of the thorax, were placed,—the one on the left pericardial region,—the other on the opposite part of the back, in such a manner that the poles may be exactly opposite, and the magnetic current may traverse the part affected. When it procured but little relief, a small blister was applied under the anterior plate with advantage. Dr. Hope (*Treatise on Diseases of the Heart*, Amer. edit., by Dr. Pennock, p. 466: Philad., 1842,) states, however, that they who witnessed the application of the magnet by Laënnec, did not, in general, form so favourable an opinion of its utility as he did. It appeared to be more successful when combined with acupuncture. Its effects are doubtless altogether revellent.]

But although these or other means may occasionally afford relief, or may even ward off death, it is evident that every kind of treatment confined to the paroxysm is of very slight importance, when compared with that which is to be employed in the interval: the former can, at most, afford temporary relief; the latter may cure the disease. It is to this part of the treatment, therefore, that the care of the practitioner is to be chiefly directed; and it is to this part of our subject that we would claim his especial attention.

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[*] The apparent influence of gas in the stomach over the motions of the heart is very remarkable. In certain nervous diseases, we have seen intermissions of the heart's action carried to such an extent that the patient's life was considered in imminent danger; and yet have known the whole symptoms instantly removed by the sudden expulsion from the stomach of a quantity of flatus!

[†] In a case related by Dr. Fothergill, simple peppermint water is said to have given great relief in this way: "It was always by him in the night, and gave him ease when a reasonable dose of paregoric had been given without benefit." *Fothergill's Works*, ii. 253.

[‡] A strongly marked instance of the good effects of venesection in the paroxysm of angina is given by Dr. Read, in the Dublin Trans. Vol. i. 105; and a good illustration of the injurious effects of prematurely stimulating a feeble heart already oppressed with its contents, is recorded in Parry's work, p. 163.

[§] Prax. Med. Univ. Part ii., vol. iii. p. 273, 274, note.

II. *Treatment in the interval.*—If it is of consequence for the practitioner to be acquainted with the precise nature of the case before him, to enable him to prescribe successfully or even safely in the paroxysm of angina, it is much more important that he should have this knowledge to direct his treatment in the interval. In many cases, no doubt, it is quite impossible to ascertain the intimate character of the affection during the paroxysm; and in a certain proportion of these, the knowledge, if attainable, would be of little use. We should still be reduced to the necessity of applying the same limited stock of means without any very inspiring confidence of a beneficial result. Circumstances, however, are very different in the interval. Here, an accurate acquaintance with the nature of the individual case is indispensably necessary to enable us to institute treatment that holds out any prospect of success; while a practice adopted at hazard, or on merely empiricial principles, may not only be useless, but may lead to the most disastrous results. The first and great object of the practitioner, therefore, on being called on to treat a case of angina, will be to make himself acquainted with its individual character. Beginning with the early history of the disease, he will trace it to its present stage, and will endeavour, from the narrative of the patient, and from the observation of the whole phenomena presented to him, to form a clear judgment respecting the local condition of the organs in which the characteristic symptoms have their site; and the state of all the other parts of the system, which can in any way influence these: in other words, he must endeavour to ascertain the species or variety of angina, according to the distinctions formerly pointed out. Are the paroxysms dependent on some structural lesion of the heart and great vessels, or are these organs in their original soundness? If there is any deviation from the sound condition of these organs, what is the nature of this deviation? Does structural lesion exist or not? or, if existing, can it be detected or not? What is the actual physical condition of the heart? Are its walls thick or thin? Are its cavities large or small? What is the state of the general health? Is it such as injuriously to influence the recurrence of the paroxysms in any way, or to aggravate their severity? If thus injuriously influencing the local disease of the heart and great vessels, is it of a kind to be remedied or mitigated by medical treatment? These queries comprehend most of the subjects of inquiry which the practitioner who proceeds to treat a case of angina, must keep in view; and although it will sometimes be impossible to obtain precise information on every point, yet this will be practicable, in the greater number of cases, by care and attention, and by the employment of the improved methods of investigating thoracic diseases furnished by auscultation. This latter method of exploration will, in a more particular manner, aid our recognition of the physical condition of the heart; and enable us, in a great number of cases, to determine the presence or absence of organic disease in that organ. This precise knowledge is, no doubt, important in assisting us to regulate our practice with the best advantage to the patient; but it is infinitely more so in enabling us to form an accurate prognosis respecting the event of the case. If the attacks recognise great structural lesion of the heart or aorta for their cause, we can only expect to mitigate the severity of the paroxysms, or to effect their temporary removal. If there exists no structural lesion of a fatal kind, although the organs may not be of the soundest proportions, it is often practicable, not merely to mitigate or remove the paroxysms, but by great and constant vigilance on the part of the patient in avoiding the exciting causes, to prevent their recurrence altogether. When the disease is purely one of functional disorder, a much more perfect and permanent cure may be expected. In all these cases, however, the general character of the treatment will not greatly vary. An organic lesion of the heart, even of an incurable kind, can only be viewed, in relation to the treatment, as a predisposing cause of the attacks, just as a heart that is naturally feeble or morbidly irritable is so; and it is only in rare cases that the organic lesion induces the paroxysm without the aid of obvious exciting causes. No doubt, exciting causes of a much feebler kind will suffice; but the very necessity of such causes at all to produce the effect, brings the case, as far as concerns the prevention of the paroxysms, under the same category as to treatment as the purely sympathetic or nervous angina. In the case of organic disease, however, our expectations of benefit from treatment, and the actual results, become wonderfully less. Now, indeed, we fight not for victory, but merely to keep the enemy at bay. We, however, use the same weapons; and if we do not strive with the same enthusiasm, we must, at least, be vigilant and active; and we shall often be rewarded with a degree of success that we scarcely dared to hope for at the commencement of our treatment. For these reasons, in the following outline of what we conceive to be the proper treatment of angina, we shall, for the most part, treat of the disease generally, and refer only to its individual forms when this becomes essential from the necessity of recommending some peculiarity of treatment.

In the small number of cases in which the anginous paroxysm depends upon organic disease of the heart, uncomplicated with other disorders of the system of a general or local kind, our mode of treatment becomes very simple. It consists, in a great measure, in guarding against the causes which obviously excite the attacks, and in observing a most cautious and rigid regimen. These measures will be more particularly noticed presently, and they will be still more fully discussed in the articles which treat of certain other diseases of the heart. The remedies of a more direct and specific kind, which may influence the recurrence of the paroxysms, will also come under our notice, after we have considered the treatment best calculated to reduce the more common and complex cases of angina to the state of simplicity now under consideration. The same remark will apply to the cases of angina of the more purely nervous kind, and also to those which are connected with mere organic feebleness of the heart. The great rarity of such cases, compared with the frequency of those of a more complex kind, renders the treatment of them of comparatively little consequence. And there is an additional reason for not entering upon the consideration of the treatment of such cases at present, namely, an apprehension lest the attention of the inexperienced reader might, in the outset, be too strongly arrested by the specific remedies applicable to them, and be thus diverted from the very different kind of management requisite in the more complex class of cases, which, unquestionably, constitute the vast majority of those met with in practice.

We must refer to other parts of this work for a detailed account of the treatment of the various disorders formerly noticed as complicating angina, or as constituting what may be termed its constitutional form. The presence of the anginous paroxysm renders scarcely any modification in the treatment necessary. On the present occasion we can only make a few general remarks on some of the most important of these complications.

Of the treatment of simple or primary dyspepsia, as co-existing with angina, we shall only here remark, that much more is to be effected by a rational system of diet and regimen, both of body and mind, than by medicines; and that, as a general rule, the cautious, cooling, and macerating treatment of our continental neighbours, will be found more successful than the endless ingestion of bitters and drastic purges, so much practised in this country. In many cases, no doubt, the stomach is simply debilitated, and requires tonics; but it is much more frequently irritated or inflamed, and requires soothing and depletion. The prevailing and most injurious error among many practitioners, is, apparently, to overlook the fact, that the stomach or intestinal canal can be inflamed without pain or the more common external marks of febrile action; or, being so, that they can be injured by the stimulus of purging. But it is in the complex constitutional disorder, which may be termed *secondary dyspepsia*, that these observations are most applicable. It is to be feared that the true nature of this disorder is not well understood by the generality of practitioners. It is one of those diseases which may often be said to be the *opprobria medicorum* in the worst possible sense; since it is not seldom caused, and is very frequently fixed and perpetuated by injudicious treatment. In no other disease is the over-active, or, as our neighbours term it, *heroic* mode of practice so prevalent in England, productive of such evil effects; and in none is that mild, simple, yet comprehensive system of treatment, which embraces the whole of the disordered organs and functions, and rather prompts nature to act rightly than supersedes her agency, so strikingly beneficial. (See DYSPEPSIA.)

In the very numerous class of cases in which a plethoric state of the system co-exists with angina, and in many of which there is either actual gout or the gouty diathesis, the chief indications will be, first, to relieve the overloaded vessels; and, secondly, to prevent their repletion. Here the most obvious and immediate remedy is venesection. This may, in most cases, be beneficially employed as a means of temporary relief, and will advantageously be combined with the use of purgatives, colchicum, &c.; but the cure of the disease, if it is curable, or its effectual relief, must depend on measures of more permanent operation. These are much more dietetical than medicinal. In the kind of cases now under consideration, and, indeed, in the great majority of all the cases of angina, a most strict regimen, and as low a diet as is consistent with the maintenance of healthy function, is absolutely necessary. It is not to be inferred from this, that the complete abandonment of animal food by the patient is recommended. This probably may be necessary partially, or for a time, but not generally. All that is essential to be kept in view is that the diet be of such a kind as not to be too nutritive, or to occasion fulness. In many persons, more particularly of the class whose cases we are now considering, an exclusively vegetable diet will prove injurious, by producing disorder of the stomach. And it is always to be kept in mind, in treating such cases, that it is almost of as much consequence to avoid local morbid irritation of this organ as to obviate plethora. We think, however, that a case can hardly occur in which it will not be proper to limit the patient to the milder kinds of animal food, and to a very moderate proportion of this; the great bulk of the nutriment being farinaceous. In certain cases, a small portion of wine may be allowed; but it will scarcely ever be proper to permit it to be taken in considerable quantity; and malt liquor must be at once and for ever abandoned, in all forms and proportions. In certain of the more violent forms of organic angina, it may sometimes be advisable to attempt the relief of the disease by a systematic reduction of nutriment below the actual wants of the system, as practised by Valsalva; and we do not doubt that, if the selection of cases for the experiment were good, and physicians and patients could be found endowed with sufficient faith and courage to enforce and undergo the trial, the very best results might occasionally be obtained. But it must be confessed that such a mode of practice is but ill suited both to the weakness of humanity and the uncertainty of the healing art.

It is in the class of cases now under consideration that counter-irritants are most indicated; more particularly if the plethora is complicated with the predisposition to gout, or with actual gout. And, certainly, of all the various remedies that have been used in angina, none seem to have been, on the whole, attended with more success than this class of agents. As a general rule, it may be observed that counter-irritation is much more beneficial in those diseases in which there existed, previously to the local affection, a well-marked disorder of the system at large, than in cases of pure inflammation produced by accidental causes in a system otherwise healthy. In the former case, the artificial irritation and discharge frequently produce relief to the system analogous in kind, however inferior in degree, to that which always attends the supervention of a spontaneous local inflammation in such cases; while the institution of an artificial inflammation in the other class of cases, has frequently no other effect than that of adding to the existing disorder and distress. Dr. Smyth, of Dublin, so far back as 1770, employed issues in several cases of angina with marked benefit, and, in two at least, with perfect success; in a third case, the disease seems to have been removed by an issue of nature's own making, viz. by a hemorrhoidal discharge, first of blood, and then of pus. Dr. Macbride, who relates these cases, expressly states that one of these patients had a strong gouty taint. (Edin. Med. Comm. vol. v. p. 12.)

In Dr. Smyth's cases, the issues were applied to the thighs; and the same practice was adopted by Darwin with equal success. "Four patients (says this author) I have now in my recollection, all of whom I believed to labour under angina pectoris in a great degree, which all have recovered, and have continued well three or four years, by the use, as I believe, of issues on the inside of each thigh; which were at first large enough to contain two peas each, and afterwards but one. They took besides some slight antimonial medicine for a while, and were reduced to half the quantity or strength of their usual potation of fermented liquor." (*Zoonomia*, vol. iv. p. 43.) The reader will understand the importance of the restriction *of the diet* mentioned in this case.

Irritants applied directly on the cardiac region have been occasionally followed by no less fortunate results. In cases related by Goodwin, (Med. and Phys. Journ. vi. 320.) Kriegelstein, (Hufeland's Journ. B. xix. St. 4, p. 131.) Lind, (Med. Chir. Rev. N. S. iv. 497.) and others, a cure appears to have been effected by the application of antimonial irritants to the chest; and, in Dr. Parr's case, great temporary relief followed the application of a blister to the same part. (*Blackall* on Dropsy, 365.) In a case noticed by Joseph Frank, great benefit, "conspicuum levamen," resulted from the insertion of an issue between the ribs in the cardiac region. (Med. Univ. Præcept. P. ii. vol. i. p. 269.) Two of Dr. Blackall's cases are very much in favour of this practice, although only offering analogical evidence of its efficacy. The subject of one of them, a gentleman who had never for a single week been free from attacks of angina for ten years together, lost every vestige of it for the last nine years of his life, during which he suffered from ulcers of the lower extremities. In another, a gouty subject, instantaneous relief during the paroxysm was more than once afforded by the application to the feet of "mustard cataplasms, quickened with oil of turpentine." (*Loc. Cit.* 409.) But it is not as isolated means, used empirically, that counter-irritants, or any other topical treatment, can be expected to produce their full measure of benefit; it is only when had recourse to as parts of a comprehensive system of treatment, embracing the whole disease, that they can be used with much prospect of success, or, indeed, that they should be used at all. When their application is so regulated, both reason and experience counsel the measure in every case of obstinacy or great severity.

A most important part of the treatment of angina is the avoidance of the exciting causes of the paroxysms. By rigid adherence to the proper regimen, and by constant vigilance on the part of the patient to eschew everything calculated immediately to induce a paroxysm, very much may be effected, even in the most hopeless cases, to alleviate suffering, and in mere functional angina a cure may very generally be expected. In all cases the patient should be so far instructed in the nature of his complaint, as to be made aware that whatever tends to hurry the circulation beyond the medium standard, is likely to induce a paroxysm, and he must have pointed out to him all the circumstances that are capable of producing this effect. He himself will, indeed, have learned, by sad experience, the chief of these circumstances, and will require no admonition to induce him to avoid them; but there may be others, of the power of which he is not sufficiently aware, which may, nevertheless, be exerting a baneful influence over his malady.

Some patients have been so bold as to endeavour to master their paroxysms by persevering in the very acts which had induced them;* and in some few cases the attempt has certainly been unattended with any bad effects, if it was not productive of good. These cases, however, were of the slighter kind; and there cannot be a doubt that, in every case, all such attempts are to be forbidden. All strong exercises, and more particularly walking up hill or up stairs, and, in a word, every species of bodily movement that is found to induce the paroxysms, must be abandoned as far as possible. Of this kind may be particularly noticed the act of stooping, as in tying the shoe-strings; drawing on boots; straining at stool; climbing a high bed, &c. &c. Those positions of the body which tend to lessen the cavity of the chest or abdomen, give double power to all contemporaneous movements that accelerate the circulation, and are therefore to be particularly avoided. It is chiefly on this account that a full meal greatly increases the bad effects of exercise; although, in this case, no doubt, the fresh stimulus imparted to the circulation by the recent aliment co-operates.

In regulating and limiting bodily exercise, however, great care must be taken not to carry our precautions too far; as insufficiency of muscular motion, by inducing morbid irritability of the nervous system, may operate almost as unfavourably as over-exertion. In all chronic nervous diseases, — and angina, even when depending on organic causes, must, in one respect, be considered as a nervous disease,—there is no species of treatment so beneficial as regular bodily exercise; insomuch that, in the practice of medicine, we are almost justified in considering the nervous and muscular systems as antagonist powers: the more the one is exercised, the less irritable and excitable the other becomes. Accordingly, in sympathetic angina and the numerous analogous nervous affections of the heart, we have invariably found the greatest benefit from a regular system of exercise, conjointly with other means calculated to restore the different functions disordered. And even in the organic angina, such exercise as can be borne must be strictly enjoined. If, from experience of the ill effects of his ordinary exercise, the patient has renounced all exercise, he must endeavour to renew the practice, beginning with the gentlest, both in kind and degree. By patiently persevering in this plan, he will often succeed in bringing the system to bear considerable exertions without augmenting either the frequency or severity of the paroxysms. That kind of exercise which is borne best, will, of course, be most used; but merely passive exercise will not produce all the effects we could desire. The muscles of locomotion must be kept in action. Riding on horseback, or walking, must therefore be enforced, as far as may be practicable or justifiable; and great care on the part of the patient, in avoiding all unnecessary trials of his powers, will often enable him to enjoy both these modes of exercise to a considerable extent. In walking, which is, on the whole, by much the best mode of exercise, the patient must strictly confine himself to level ground, and must not face the wind. For these reasons, the nature of the place of residence becomes frequently a matter of much consequence. If we are justified in sending other patients with chronic diseases from their homes, for the sake of a difference in the climate, we are warranted in doing the same, in the case of anginous patients, in order that they may obtain the advantage of a flat country, or sheltered walks. Change of air, indeed, in the usual sense of that phrase, is very beneficial in many cases of angina; but whenever this is recommended, the configuration of the surface of the new locality, and its degree of shelter from winds, must be considered as much as the nature of the climate. Occasionally we meet with instances in which hardly any degree or form of exercise can be borne; the wretched sufferer being reduced, through the ever-present terror of a paroxysm, to a state of almost vegetable immobility. In such cases it will generally be found that the only succedaneum for the exercise that can no longer be taken, is a system of diet so rigid as to approach the limits of starvation; and if the patient has sufficient courage to pursue this course, a greater relaxation from suffering may still be obtained than could have been anticipated.

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* A remarkable example of this occurred to the writer of the present article, while transcribing it for the press, in the person of a gigantic farmer, who seemed to fancy he ought to rule diseases as he ruled his team. When the paroxysms attacked him on horseback, he would throw the reins on his horse's neck, put him to a canter, and bear his agony till he could sit no longer! When fairly beaten he came to the doctor, but it was too late; he died suddenly during the night, not more than eight days after his first visit.

A most important chapter in the history of all diseases immediately connected with the functions of the heart, is that which treats of their relation to mental impressions; and in no case is the consideration of this relation so important as in the prophylaxis of angina. Two varieties of mental affections act powerfully on the functions of the heart,—the depressing and the exciting passions. It may be difficult to prove that anxiety, care, grief, or any other form of mental distress, does ever of itself and directly produce disease of the heart; because such states of mind, if continued, are followed by various other bodily disorders which powerfully co-operate in deranging the functions, and eventually the structure of this organ. But no one who has lived in the bustle of life, and seen much practice, will doubt for a moment that the mental states now referred to are among the most prevalent and most influential of the remote causes of such diseases. When angina already exists, it must be admitted that these, as well as the exciting passions, are among the most frequent exciting causes of the paroxysm. The result of the operation of both classes of emotion is the same, although somewhat differently brought about; namely, an accumulation of blood in the heart disproportioned to its powers of propulsion. It is doubtful which of these causes is the most powerful. The exciting passions are usually considered as such; but it is probable that this opinion may have taken its rise from their more ostentatious nature. Anger is a social and public passion; it is clamorous, and will be both seen and heard. Grief is retired, silent, and secret; it is more conspicuous in its effects than in its working. Anger is, no doubt, also quicker in its operation than sorrow; and the open and instantaneous manifestation of its power in diseases of the heart has procured for it a greater reputation than has fallen to the lot of its less obtrusive but still more formidable sister. Very many examples of sudden death from anger, in diseases of the heart, are recorded; and not a few of these have occurred in cases of angina. These statements prove the great importance of mental discipline in this disease; and although "herein the patient must minister to himself," it is the duty of the physician to point out to him the necessity no less of the moral than of the physical means of prophylaxis.

It will be remarked that, in the preceding observations, we have taken no notice of specific remedies for the relief or cure of angina. The consideration of these has been purposely deferred until now, with the view of impressing upon the mind of the reader the much greater importance of those plans of treatment, which have reference to some obvious or intelligible disorder of the system. When no such disorder exists, or when, having existed, it has been removed, or, at least, has been *attempted* to be removed by every rational means which medical science affords, then, and not till then, are we justified in making trial of that class of remedies of whose mode of operation we are ignorant, and which have been denominated *specifics*. In certain cases, means of this kind have certainly had excellent effects. After the ample discussion given to the more general method of treatment, we cannot here enter upon any detailed statement of these effects; much less can we attempt any explanation of their mode of action. A consideration of the various nature and numerous complications of angina, as detailed in the preceding pages, will show that remedies of this class may possibly possess very different powers and modes of action, and yet lead to the same results. Bark, iron, arsenic, nitrate of silver, the salts of copper, zinc, and other medicines both of the vegetable and mineral kind, have been frequently employed. In a few instances, narcotics, such as hydrocyanic acid, belladonna, &c., have been found useful. In those cases in which the paroxysms approach nearest to the purely neuralgic character, remedies of this kind hold out the greatest prospect of success. If there is any reason to suspect a malarious origin or complication, bark, or rather quinine, will be found most efficient. In other cases steel and arsenic will deserve the preference. Of all the preparations of iron, the common carbonate and the sulphate seem the most powerful in nervous diseases. The former must be given in large doses, as from a scruple to a drachm, several times a day. When the stomach and general system were in a proper state for their reception, we have found these medicines frequently of much benefit in diseases of the heart, whether organic or sympathetic; and they have often been found to mitigate, if not remove, the attacks of angina. The salts of copper have also been often tried; we are not, however, aware of any very successful result having been obtained from their use. Arsenic and zinc have been productive of more benefit. Several cases, evidently relieved or cured by these salts, are recorded by authors. A well-marked case of angina, cured by Fowler's solution, has been published by Mr. Alexander, (Edin. Med. Comment. xv. 373;) and another cured by white vitriol is given by Dr. Perkins, (Mem. Med. Soc., Lond. iii. 580.) The great length to which this article has already extended prevents us from entering into fuller details. The reader who has studied the pathology of angina can have no difficulty in knowing when to apply specific remedies, and which ought to have the preference.

John Forbes.

[**ANIMAL MAGNETISM.** (See Somnambulism.)

ANIMATION, SUSPENDED. (See Asphyxia.)]

ANODYNES. The word *anodyne* takes its origin from the Greek, α, privative, and ὀδύνη, pain; and the literal meaning is, *a remedy which removes pain.* The term *anodyne* is often used synonymously with the terms *narcotic* and *sedative*; but as these three words are all different in their strict signification, it is obviously right to confine the employment of each of them to its proper acceptation. In a work like this, an important end is answered by taking up, as distinctly as possible, the subject which is suggested by the word which stands at the head of each article; and on this account *narcotics* and *sedatives* will not be particularly mentioned in this place, although they are generally classed with anodynes, as remedies which produce a similar effect on the animal body.

When the practitioner wishes to relieve *pain*, he ought to ascertain, if possible, in the first place, what is the cause of the pain. The sensation of pain seems to be essentially connected with the operation of the nervous system: it may arise, 1st, from an undue degree of pressure being made upon the nerves, or from an injury sustained by external violence: 2dly, from increased sensibility in the nerves themselves; so that the pressure of external objects, which, under ordinary circumstances, only produces the proper sensation of touch, or as in some parts, even no sensation at all, gives origin to a painful sensation. This increased sensibility may be the result of many different causes, *e. g.*, of morbid structure or of morbid function of the brain, or of the spinal marrow, or of the nerves themselves. When this increase of sensibility occurs, pain may only be felt when external pressure is applied, and then it is denominated *tenderness*; or the pain may be felt independently of such pressure. It is very probable that in some painful diseases there is nothing morbid except the function of the nerves themselves; no organic alteration, no inflammation, being discoverable either before or after the death of the patient. Pain in such cases is commonly called *neuralgia.* It occurs sometimes in paroxysms, leaving intervals of ease more or less complete; sometimes it is constant. Tic douloureux and the periodic face-ach are instances of this species of disease of the nerves.

We know very little of the real nature of sensation. The opinion of Dr. Cullen, that a subtile fluid pervades the nervous system, that this fluid is thrown into motion by the application of certain agents, and that thus sensation is produced, is too conjectural and vague to be adopted by any modern physiologist: the same may be said of all other known hypotheses on this subject. It must therefore clearly appear impossible to afford a satisfactory explanation of the real nature of the sensation of pain. Probably that peculiar property of the nervous system which we denominate *sensibility*, or the capability of feeling, becomes so increased, in some instances, as to produce, by itself, the sensation of pain (these would be called instances of neuralgia); yet in other cases the sensibility in the nerves seems to be increased and pain produced by certain appreciable changes in the condition of the part which is the seat of the pain; and this may be illustrated by what occurs in inflammation; pain being almost the constant accompaniment of the other symptoms. On examination of the different parts of the body in their natural condition after death, those which are the most sensible to the touch are found to be more plentifully supplied with blood-vessels as well as nerves; as, for example, the ends of the fingers and the lips; both of which parts may be considered as instruments of touch: and it appears that the large supply of blood sent to them is more than sufficient for the process of nutrition. This fact, taken in connection with another, which has been a matter of frequent observation—viz., that when the flow of blood to these parts is interrupted, without any injury having been done to the nerves themselves, numbness to a certain extent is the consequence,—leads us to conclude that the sensibility of a nerve bears some proportion to the quantity of blood circulating in the capillary blood-vessels in connection with it. We should therefore expect, that when, as in the case of inflammation, a larger quantity of blood is thrown into these vessels, an increase of sensibility of the nerves would be the consequence. Many physiological and pathological facts might be adduced in corroboration of the opinion just stated; but enough probably has been said to answer the present purpose, which is to show that the increased sensibility of a part in inflammation depends very much on the increased determination of blood to the part inflamed.

Besides external violence and increased irritability of the nerves, either connected with or independent of inflammation; inordinate contraction of the muscles, or *spasm*, must be mentioned among the causes of pain, and of pain, too, sometimes of the severest kind. The probable explanation of the production of pain by spasm is afforded by the circumstance of the pressure which must be made upon the nerves by the contracting muscular fibre, and must give origin to excessive sensation. Of course when the nerves are rendered morbidly sensible by inflammation, or by any other cause, the pain from spasm will be more severe. Many facts warrant the conclusion that, in some morbid conditions of the body, excessive sensibility of the nerves and muscular spasm often co-exist, as essential parts of the same disease. It would not be in place to inquire here whether the sentient nerves, or the nerves of muscular motion, or whether both, are those affected when pain is produced by spasm : indeed it seems to be a point which we cannot determine, and probably we should derive no practical advantage from the knowledge were we able to gain it.

Pain may be alleviated or subdued, 1st, by the removal of the remote cause, such as inflammation, spasm, external pressure, &c.; 2dly, by the employment of remedies which reduce the degree of the sensibility of the nerves ; and, 3dly, by the employment of remedies which render the brain so torpid as not to allow the patient to feel the effect of the usual causes of pain when they exist.

On the first of these heads very little need be said in this place: indeed, the general means which ought to be employed for the removal of the diseases which are attended with pain cannot be properly classed among the remedies which are strictly called *anodynes*, although pain, along with the other symptoms of such diseases, is removed by them ; it may however be, with propriety, remarked, that in such diseases as inflammation and spasm, the pain may often be suspended during their continuance by the medicines which are strictly called anodynes, i. e., medicines which reduce the sensibility of the nerves, or produce a torpor of the brain, and that it may occasionally be very desirable to administer them for that purpose. In spasm, indeed, the same remedies which are calculated to allay pain, will frequently also allay the inordinate action of the muscular fibre, (*vide* ANTISPASMODICS ;) and in many cases of painful disease, anodynes may, by deadening the patient's feelings, prove auxiliaries to those remedies which are given with a more direct view to the removal of the disease itself ; for as the sensation of pain frequently acts upon the system as a kind of irritant, so the suspension of that sensation by means of an anodyne, may, in many diseases of excitement, allow such diseases to come more completely under the operation of the remedies which may be administered to subdue inordinate action. In many instances too, the comfort of patients may with propriety be consulted, and their sufferings soothed by the employment of anodynes, when they are not contra-indicated, in diseases of a painful nature. Besides, it is necessary, in many diseases attended with pain, to endeavour to procure sleep, and this can be only done by the suspension of pain ; for pain is a common cause of watchfulness, and for this purpose anodynes are frequently our only resource.

The exhibition of anodynes in inflammation, however, requires the exercise of much judgment. This remark appears to be the more necessary, because the employment of some of them, especially of opium and the prussic acid, has been of late strongly recommended as antiphlogistic remedies : whether they are antiphlogistic or not is not now a question for our consideration, the present object being to guard the practitioner against their indiscriminate employment in inflammation. Pain, or tenderness, is one of the most unequivocal signs of the existence of inflammation, when taken in connection with its other symptoms ; and during the treatment of inflammation, when no *anodynes* have been employed, the continuance of the pain will often afford an indication, to the practitioner, that further active measures are necessary : but it is quite certain that inflammation, in a considerable degree, may be going on while all feeling of pain is suspended by the effect of an anodyne ; so that in such a case the indication of pain will be lost, the disease may be rendered obscure, and the treatment inert. Besides the reason just assigned for caution in the employment of anodynes, the stimulating quality which some of these remedies possess, ought to put the practitioner on his guard against the indiscriminate use of them when treating inflammation. It appears better, then, for the purpose of relieving pain, to depend generally on the means calculated to lessen or remove the inflammation itself, at least in all recent and active cases : this must be considered the most judicious mode of easing the feelings of the patient ; but instances are daily met with in practice, especially of chronic inflammation, where the suspension of pain by anodynes is indicated by the considerations which have already been assigned.

The medicines which are strictly called anodynes, act either by reducing the sensibility of the nerves, or by rendering the brain so torpid that painful feelings are not noticed. It may be fairly questioned whether these medicines, when they are administered by the stomach, do not all produce their effects in the same manner, by reducing the sensibility of the whole nervous system, and by thus rendering it less susceptible of feeling ;— all of them, when carried to a sufficient extent, cause the brain to become torpid, and conduce to sleep ; and therefore they are not only placed on the list of *anodynes*, but also on that of *narcotics*. It is not, however, to the production of sleep that their anodyne quality is to be solely referred, because, not unfrequently, perfect ease from pain is enjoyed by a patient through their instrumentality, although the mind is as wakeful as ever. When, however, these remedies are applied locally to painful parts, the action may be entirely local ; although when long applied in that manner, or applied in large quantity, they will sometimes show an effect on the brain, and it would be too much to assert positively that their action is in any case entirely local.

As a morbid degree of sensibility seems sometimes by itself to constitute a painful disease, the employment of anodynes may be occasionally required as the principal means for the cure of such disease : for this purpose it will be generally necessary to continue them for some length of time.

The following is a list of anodynes which are most commonly used.

Opium.
Hyoscyamus niger, (*Henbane.*)
Atropa belladonna, (*Deadly nightshade.*)

Conium maculatum, (*Hemlock.*)
Datura stramonium, (*Thornapple.*)
Acidum hydrocyanicum, (*Prussic acid.*)

The doses and modes of administering these remedies will be mentioned under the article NARCOTICS. Some others also will be there noticed, which are occasionally employed as *anodynes* as well as *narcotics*; for whatever produces torpor of the brain and sleep, must, in accordance with the views already given, be capable of alleviating pain. Certain other articles of the Materia Medica, besides narcotics, occasionally suspend pain, and may therefore be considered *anodyne* in their operation. These are the ferri subcarbonas, cinchonæ cortex, and the arsenicum album. It is undoubtedly true that these are efficacious remedies in many painful diseases; but it is very questionable whether they ever act directly on the sensibility of the nervous system; they appear rather in such instances to be capable of suspending the morbid action on which the increased sensibility and pain depend, and therefore, strictly speaking, the application of the term *anodyne* to them does not appear proper.

JOHN WHITING.

ANTHELMINTICS.—This term is applied to substances intended to destroy, and to expel from the body, intestinal worms. [The definition ought also to be extended so as to embrace agents that prevent their generation. The great object, indeed, is to remove the predisposition to their generation. The anthelmintics that destroy or expel, merely remove the parasites already present in the alimentary tube; but unless the pathological condition that gives occasion to their reproduction is removed, the evil will constantly recur.] In order to acquire a full knowledge of the manner in which these substances operate, and of their practical utility, we ought to make ourselves familiar with the natural history of intestinal worms; but as this information is given under a distinct head in this work, we shall confine our remarks, in the present article, to the means of relieving the body from these parasitic animals.

The remedies belonging to this class of the Materia Medica are various, and on this account we regard that arrangement the most useful, in a practical point of view, which refers to their mode of operation. The whole class may be conveniently arranged under three heads:—*evacuant* anthelmintics; *specific* anthelmintics; *corroborant* anthelmintics.

I. *Evacuant* anthelmintics are substances which dislodge and expel worms from the intestinal canal, whether by a mechanical, a chemical, or a cathartic action.

1. Among those evacuant anthelmintics which operate mechanically, we consider two preparations only worthy of notice,—granulated metallic tin, and the setæ of the pods of the dolichos *pruriens*. Tin, *stannum*, appears to have been used as an anthelmintic, in combination with common salt and some other purgatives, by Paracelsus; (Opera Medico-Chemica. Liber de Preparationibus); and it is mentioned also by Quincy, (*Quincy's* Pharmacop. p. 246,) as a vermifuge; but it was particularly introduced to the notice of the profession, in 1736, by Dr. Alston, (*Alston's* Lectures on the Mat. Med. vol. i. p. 150,) who prescribed it, for the first dose, to the extent of an ounce, mixed in treacle; for the second, which was not administered until three days after the first, half that quantity; and then finished by giving a purgative, which generally brought away the worms. It is now prescribed in much smaller doses; not more than a scruple, or at most a drachm being given for a dose; but this is repeated three or four times a day for four or five successive days, and is followed by a brisk cathartic. We have found it useful chiefly in those cases in which the ascaris *lumbricoides* was present. Lewis and many others erroneously attribute the benefit derived from this employment of tin to the arsenic which it frequently contains; others ascribe it to the tin being solvent in the gastric juice, and thus forming hydrogen gas, which is poisonous to the worms; an opinion which is supposed to be supported by the efficacy of the aurum musivum, sulphuretted oxide of tin, which was formerly much employed as an anthelmintic. In France a nearly similar opinion of the poisonous nature of tin is maintained; for wine exposed in tin vessels is prescribed as a vermifuge. One forcible argument against these opinions is derived from the fact that the worms are generally voided alive; and there can be very little doubt that the benefit is derived solely from the mechanical irritation of the worms by the grains of the tin—an opinion which is rendered more probable by reflecting on the manner in which lumbrici dispose themselves in the canal. "The dissection of one subject has shown me," says Mr. Rumsey, "that they dispose themselves in the most curious and tortuous form, such as I thought exactly adapted to the exertion of their muscular power against opposite sides of their cylindrical abode, resisting, by this means, the effect of the propelling motion of the canal, and thus keeping their station. An illustration of this mode may be found in the art employed by a chimney-sweeper to counteract the effects of gravitation by pressing against opposite sides of the cylinder in which he exerts his skill." (Medico-Chirurg. Trans. vol. ix. p. 401.) The irritation excited by the tin prevents them from retaining this position, and causes them to be easily expelled. The other mechanical agent well adapted for expelling the round worm, ascaris *lumbricoides*, is cowhage, dolichos *pruriens*—[*mucuna*, of the Pharmacopœia of the United States, 1842,]—a very common anthelmintic in the West Indies. The setæ on the outside of the pods are scraped off, after sheathing them by dipping the pods in syrup, and then formed into a kind of electuary, which is given in doses of one or more teaspoonfuls, early every morning, for three successive mornings; this is followed by a brisk cathartic. The setæ, in the same manner as the tin, wound and irritate the worms, obliging them to leave their hold on the coat of the intestine,—at least this is the usual opinion of their mode of acting. A dessert-spoonful of the electuary is given to an adult, fasting, for two successive mornings: many worms are usually evacuated after taking the second dose, particularly if the long thread worms be present. The cathartic is generally requisite to aid their expulsion, and if it consist of calomel and scammony, any ascarides

present in the rectum are expelled at the same time. Neither the powder of tin nor the cowhage are now so generally employed as they formerly were.

[The short, stiff bristles on the tube which terminates the coriacious and scaly involucre or cupula that surrounds the nut of *corylus rostrata*, 'beaked hazel,' have been found to possess similar virtues to those of mucuna. They may be given in the same vehicle and doses. (*Amer. Journal of Pharmacy*, Jan. 1843; and Dunglison's *New Remedies*, 4th edit. p. 200: Philad. 1843.)]

2. The chemical anthelmintics of this (the evacuant) division operate in two ways; either purely chemically, by dissolving the viscid mucus or slimy secretion in which the worms are involved; or, besides doing so, also by stimulating the mucous membrane, and by improving the nature of the secretion, preventing the accumulation of the slime. Lime-water and pure alkalis may be regarded as almost simple chemical vermifuges; the former is perhaps more useful, especially for removing the ascarides, when it is administered as an enema. When taken into the stomach, the dose should not be less than four ounces; and it is useful to combine it either with infusion of gentian or of chamomile flowers. If the solution of the alkalis, or their carbonates, be employed, the dose should be carried to its utmost extent, beginning with small doses; for example, from twenty to thirty minims, and gradually increasing the number of minims daily until two drachms or more be taken twice a day. The alkalis also may be given in bitter infusions, that of tansy for instance, and combined with some essential oil in the form of an oleo-saccharum.

3. The purgative anthelmintics have no other effect than clearing away the superabundant mucus, and such worms as are detached from the coats of the intestinal canal, and can be expelled in conjunction with the mucus. Amongst the saline purgatives, common salt and sulphureous waters, such as those of Harrogate, have been found most useful. The common salt combines a tonic with its purgative property [and is positively detrimental to entozoa when they are out of the body]. It may be given in doses of a scruple to an ounce dissolved in a large quantity of water, or double the quantity may be exhibited in the form of enema, when the rectum is much infested with the ascarides *vermiculares*. The Harrogate water, besides purging, operates as a poison to the worms by the evolution of the sulphuretted hydrogen gas which it contains. Rhubarb, scammony, and colocynth, [castor oil, and croton oil] operate as simple evacuants; and, for the same reason, gamboge is sometimes employed: they are generally ordered with a view of operating as cathartics after the employment of other anthelmintics. One of the most common of the means of expelling worms in children is to give a large dose of calomel at bed-time, and on the following morning an ample dose of scammony with sulphate of potassa: a large portion of bile is thus brought down into the bowels, which aids greatly in discharging the mucus of the intestines. In the cases of children, indeed, active purging is borne with much less inconvenience than in those of adults; and the first object is always to effect as much as can be done by cathartics, and then to have recourse to other means.

II. *Specific* anthelmintics are substances which destroy the worms by some poisonous principle. The Materia Medica is rich in such articles, but many of them have been overrated, and are little worthy of notice; we shall, therefore, bring before our readers those only which experience has ascertained to be valuable. The rectified oil of turpentine, the best of these specifics, was introduced into practice by Dr. Fenwick, for the destruction of the tape-worm. It is usually given in doses of a fluid ounce, or an ounce and a half, which sometimes produce sickness and purging, and occasionally intoxication, but rarely tenesmus or strangury; for in large doses its cathartic influence evidently stands in the way of its absorption, and prevents, in particular, its effects on the urinary passages. In some habits large doses cause a sensation of chilliness and a tendency to sleep; this has been, in some instances, partially obviated by administering the oil soon after a meal. In almost every case treated with oil of turpentine which has come under our notice, the worm has been expelled lifeless, and of a livid hue; the poisonous quality of the oil on these parasites is therefore obvious. In a few instances we have had occasion to aid its purgative effects by castor oil, which appears to answer extremely well; indeed this oil has been lauded by Drs. Odier and Dunant, of Geneva, as a specific in tænia.

The beneficial effect of oil of turpentine in tænia led to its employment as a remedy for the destruction of other worms. In the hands of Mr. Rumsey and others, it has been found very successful in cases of lumbrici, when given in smaller doses. To a child of about three years of age, it was given in doses of half a drachm, mixed with four drachms of thin mucilage of gum arabic, twice or three times a day; and "continued a week, with some interruptions, within which space one hundred and twenty, mostly full grown, lumbrici were brought away."* It has also been prescribed in the form of enema, to the extent of half a fluid ounce sheathed with mucilage of starch, for removing the common ascarides from the rectum; some caution is requisite in this mode of using it; but when it can be administered, the worms are discharged in great abundance.

[*Animal oil, Dippel's oil*, which is identical with the *oleum cornu cervi*, or *oil of hartshorn* of the older Pharmacopœias, is highly extolled, by the Germans more especially, and it is unquestionably very efficacious, even in cases of tænia; but it is exceedingly nauseous, and few stomachs can retain it. Its dose is from five to twenty minims, in molasses, for three mornings in succession,—following up the last dose by a brisk cathartic.

The *empyreumatic oil of Chabert*, made by adding one part of animal oil to three parts of oil of turpentine, leaving them to combine for four days, and then distilling three parts, has also been greatly praised as an anthelmintic. It, likewise, is very nauseous; but it is very effective, in the dose of a teaspoonful, in molasses, two or three times a day.]

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* Trans. of the Medico-Chirurg. Society of London, vol. ix. p. 403.

The powerful poisonous influence of tobacco on animal life has induced some practitioners to employ it as a vermifuge in cases of ascarides: it is thrown into the rectum, both in the state of infusion of the dried leaf, or as smoke. In either form, the danger attending its employment is sufficient to cause its rejection from the list of anthelmintics.

The root of the male fern was employed as an anthelmintic as early as the time of Dioscorides: it was afterwards neglected, and occasionally revived, until the success of Madame Nouffler's practice, in the eighteenth century, established its reputation as a remedy for tape-worm. According to Madame Nouffler's directions, three drachms of the powdered root were given in the morning, after the patient had been prepared by the exhibition of an enema on the preceding night; and two hours after the dose of the fern-root had been taken, a bolus, consisting of twelve grains of calomel, twelve of scammony, and five of gamboge, was also administered. This practice proved frequently successful; but, with Cullen, many practitioners have attributed the benefit chiefly to the purgative; an opinion, however, which has been shaken by the analysis of the fern-root by M. Peschier, of Geneva, who discovered in it a volatile oil to which he attributes all its activity. Thirty drops of this oil are equal to three drachms, or a full dose, of the powder: it may be given either in the form of an oleosaccharum made into an emulsion with almond mixture, or of pills made with crumb of bread. One half of this dose is given at bed-time, and the other half on the following morning, on the empty stomach; and if it do not purge, a dose of castor oil should be given in the afternoon of the same day. The success of M. Peschier with this oil appears to have been considerable, and has been confirmed by the experience of others. In every instance the worm was voided lifeless; whence we may infer the accuracy of the opinion, that it is this oil which acts as a poison when the powder of the fern-root is administered. [See Dunglison's *New Remedies*, 4th ed., p. 312: Philad., 1843.]

The bark of the geoffroya *inermis*, or bastard cabbage-tree of Jamaica, and the powdered roots of the Indian pink, spigelia *Marylandica*, have been stated to be as certain anthelmintics for the removal of lumbrici as the oil of turpentine and the male fern for that of tænia. The former was introduced to the notice of the profession by Mr. Duguid, of Jamaica,* and was much extolled by Dr. Wright, who published the botanical characters of the plant. (Phil. Trans. vol. lxxviii. p. 507.) The best form of exhibiting it is that of decoction, made by boiling an ounce of the bruised bark in two pints of water, down to a pint. The dose for an adult is two fluid ounces, which generally purge, producing also a slight degree of nausea; but if cold water be drunk during its operation, violent vomiting and much fever supervene, which, however, are quickly relieved by purging with castor oil, and the free administration of warm water acidulated with a vegetable acid. Although the active principle of this bark is still unknown, it is very evident that it operates as a specific poison to the worms; and this opinion is confirmed by the fact, that, when it is tardy in its operation, and requires the aid of a purgative, its anthelmintic effect is more decided. It is seldom employed in England.

The Indian pink appears to operate in its recent state as a narcotic, unless it be given in doses sufficiently large to secure quickly its cathartic influence; but in the dried state in which it is usually found in this country, its narcotic property, if it possess any in this state, is exhausted in the destruction of the worms, as we have never perceived its effects on the system of the patient. It is administered in powder, in doses of from ten grains to a drachm; but as far as our experience has gone, it requires the aid of some other purgative to secure its anthelmintic influence in moderate doses; and the violent effects of a large dose are too hazardous to be recommended.

[It is much used in the United States as an anthelmintic. Dr. Wood, indeed, thinks that it stands there at the head of the anthelmintics. (*Dispensatory of the United States*, 5th edit., p. 682: Philad., 1843.) It is certainly highly esteemed by many practitioners; but others have equal confidence in chenopodium, and much more in oil of turpentine and its combinations.

The bark of the root of pomegranate (*Granati Radicis Cortex*, Ph. U. S.) has been much used in tænia; but the testimony in regard to it is discordant. It is almost always given in decoction, which may be prepared with two ounces of the bark, boiled in a quart of water down to a pint and a half. Of this, the dose is two fluid ounces every half hour, until the whole is taken. (Dunglison's *New Remedies*, edit. cit., p. 332; and his *General Therapeutics and Mat. Med.*, i. 211: Philad., 1843.)

The seed of *Chenopodium Anthelminticum*— 'wormseed' — *chenopodium* of the Pharmacopœia of the United States — is one of the most popular anthelmintics. The common mode of prescribing it, to a child three or four years of age, is to mix one or two scruples of the powder with molasses; administering this for three nights in succession, and directing a cathartic on the following morning. The distilled oil, *oleum chenopodii*, or wormseed oil, is officinal in the Pharmacopœia of the United States. It is administered in the same manner as the powder, in the dose of from four to eight drops, mixed with sugar or molasses.

The *wormseed* of Europe is the fruit of Artemisia Santonica, or of a variety of A. maritima.]

The only other anthelmintic of this division which requires notice, is one which has been very seldom, if ever, employed in this country; and we bring it before our readers only because we have seen its active principle, *veratria*, operate in expelling lumbrici, when it has been administered, with another intention, in the form of wine of colchicum. The seeds of the veratrum *sabadilla*, the substance to which we refer, have been long celebrated on the continent as a specific in tænia *lata*, and are much extolled by Séeliger and M. Brewer. The latter prescribed the powdered seeds in doses of three grains, which were taken on an empty stomach in the morning, for eight successive days; and these, on the ninth day, were succeeded by a strong dose of gamboge and valerian. It is not easy to explain the beneficial effects of this plan of treatment without referring it to the veratria, which, besides acting as a direct poison to the worm, stimulates the gall-ducts, and, bringing a large portion of acrid bile into the duodenum, sweeps out the dead worms. In this manner we have seen the wine, and the other preparations of colchicum, operate, in expelling lumbrici; but we have had no experience of their influence in tænia.

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* Essays, Physical and Literary, by a Society in Edinburgh, 8vo. 1770, vol. ii. p. 290.

III. It only remains to notice the last division of this class of medicines, *corroborant* anthelmintics. All the substances, in the first divisions, act merely upon the worms already existing in the intestines, either destroying them or expelling them in a living state; thence the necessity of adopting means for preventing their recurrence; and as debility favours their production, it is obvious that tonics are indicated. All the bitters may be employed for this purpose, but the chalybeates have with much reason been preferred. At one time it was supposed that the preparations of iron are poisonous to worms, an opinion founded upon the observation that the earth-worm dies when submersed in chalybeate solutions: but the fact that the earth-worm respires by the skin, which is not the case with intestinal worms, was overlooked; and it is now generally admitted that the chalybeates operate as anthelmintics by their tonic influence, strengthening not only the alimentary canal, but the whole system. Among the preparations of iron, the sulphate was extolled by Boerhaave, who gave it to the extent of a drachm, dissolved in a pint of water, in divided doses, within twenty-four hours. We have found the milder preparations, particularly the tartarized iron, operate more favourably with children and females, who, as we have already said, are the chief subjects of worms. After clearing the bowels with a large dose of calomel and scammony, we prescribe the tartarized iron, in doses of a fluid drachm of the solution, to be taken three times a day: but the wine of iron, in similar doses, or the tincture of the acetate of iron, of the Dublin Pharmacopœia, in doses of fifteen or twenty drops, given in milk, will answer the same purpose. In cases of ascarides, chalybeate water, such as that of Tunbridge, has been found to be extremely useful when administered as an enema.

A. T. THOMSON.

[ANTHRACION (from ανθραξ, 'a coal'). This affection has an extensive synonymy;—*Pustula maligna*, *Vesicula gangrænescens*, *Malignant vesicle*, *Malignant pustule*, and *Persian fire*. In France it is known under the names, *Pustule maligne*, *Feu Persique*, *Mal-vat*, *Bouton malin*, &c.; and in Germany under that of *Milzbrandkarbunkel*. It is characterized by the appearance of a bleb filled with reddish sero-sanguinolent fluid, under which a small lenticular induration is formed, which is speedily surrounded by diffuse inflammation of an erysipelato-phlegmonous character. The inflammation terminates in gangrene, which spreads rapidly from the centre to the circumference of the tumour. This is the general character of the affection; but at times a white line of demarcation checks its progress: at others, the cellular tissue becomes rapidly disorganised, and deep caverns form beneath the skin. When gangrene strikes the central part, the inflammation extends to a considerable distance around,—the skin being red, tense, and shining, and the subcutaneous tissue swollen, infiltrated, and often emphysematous. The affection is generally accompanied by great constitutional disturbance; and in its progress, the symptoms become markedly adynamic, and the patient often sinks and dies within the first twenty-four hours from the onset. When it terminates favourably, the phenomena are the same as in cases of local gangrene in general; a line of separation occurs, and the constitutional symptoms improve.

It is the common belief that anthracion occurs only from the contact of the matter of carbuncle of animals. Accordingly, it appears on parts of the body that are ordinarily or accidentally exposed. Thus, it is often seen on the face; never on the scalp; and most commonly on the hand, forearm, arm and neck. (Rochoux, *Dictionnaire de Medecine*, tom. 26. p. 510: Paris, 1842.) It would seem, however, that it may originate spontaneously in man.

The treatment, where the disease is produced by the contact of virus, may be divided into that which is proper, whilst the affection is entirely local; and into that which is necessary, where the constitution becomes implicated.

The plan thought to be most successful, in the first case, is to make incisions through the gangrenous parts, so as to permit escharotics to come in contact with the sound textures, and induce in them a new action. A strong solution of nitrate of silver, from 20 to 40 grains to the ounce of water, or liquid muriate of antimony, or diluted or even strong muriatic acid, may be applied by means of dossils of lint. By some, potassa has been advised; and by others, chloride of zinc. The escharotics may remain on a few hours; after which, turpentine dressings, or warm poultices, may be substituted. On the next day, if there be no appearance of an extension of the disease, the soothing treatment may be pursued, or poultices, to which aqua chlorini has been added; or an ointment of the same; or a cataplasm or ointment of chlorinated lime may be used. The internal management must be the same as in gangrenous affections in general. Tonics are demanded; and opiates may be needed to allay suffering. (*Practice of Medicine*, 2d edit. p. 113: Philad., 1844.)

ROBLEY DUNGLISON.]

ANTIPHLOGISTIC REGIMEN, (from ἀντί, contra, and φλόγωσις, inflammatio). The term antiphlogistic regimen implies the accessory treatment required in aid of medical discipline for the removal of fever or inflammation. So essential is this aid, that neglect of it may render fruitless the most judicious course of medical treatment, on which account it merits the serious attention of every practitioner.

As the medical treatment of fever and inflammation will be treated of under the proper heads, it is unnecessary in this article to do more than notice the assistant means by which its end may be promoted. These may be considered as they regard bodily rest, diet, air, temperature, and mental repose, under which all that is essential may be included.

Bodily rest.—Fever and inflammation being characterised by morbid excitement, which, when excessive or unrestrained, is the source of much injury, and to allay which is the object of medical interference, it becomes important to avoid every influence by which it might be prolonged or exasperated. Bodily exertion increases excitement, and should therefore be suspended by consigning the patient, if not in every instance to bed, at least to perfect quietude. Under fever the whole muscular system becomes debilitated, and even slight exertions are not made without an effort far greater than would be required in a state of health. During such effort the motions of the heart, already too frequent, become still further accelerated; more blood is transmitted to the lungs than can find a free passage through them, and the breathing is hurried in proportion. Such disturbance of the important functions of the heart and lungs is eminently unfavourable to the objects which the physician has in view. Independently of locomotion, even the erect posture is not sustained by a frame debilitated by febrile derangement without a painful effort, and is badly borne. Under febrile or inflammatory diseases requiring active treatment, therefore, it is always advisable to enjoin perfect rest and a recumbent posture, to ensure which the patient should be kept in bed in all cases where there is much excitement to allay.

Diet.—This requires to be regulated both as to quantity and quality. Happily, under fever appetite pretty generally declines, and the patient is thus debarred from taking what would aggravate his disorder. The suggestions of nature are always worthy of attention, and in no instance are they more clearly announced than in the inappetency which attends the febrile state. In the exposition of fever and of inflammation given in this work, it will be seen how completely this disinclination for food accords with what our best knowledge of fever enjoins. During acute fever or inflammation, abstinence is essential; and so long as they continue active, the standard of diet can hardly be too low. Simple diluents are all that the stomach can bear, or the patient require, and even with these the stomach should not be oppressed. So powerful is mere abstinence in abating fever, that it might almost be laid down as an axiom, the more perfect the abstinence, the less will be the necessity for medical agency. The remarks here made on the quantity of food apply with even greater force to its quality. It is familiarly known that animal food is more nutritive than vegetable; consequently animal diet must be unsuited to a state of disease in which nutritive matter is already relatively in excess. However opinions may differ on the connexion of fever with an antecedent state of plethora, all will agree that under fever the ordinary expenditure of nutritive matter in the several secretions of health becomes diminished, from the secretory functions by which the several tissues are nourished failing in their wonted energies; whence the nutriment with which the blood is, on the accession of fever, already charged, can no longer be beneficially disposed of, and becomes oppressive to the system. To add to the load by more diet, and especially by diet so nutritive as that which animal matter furnishes, cannot be judicious. Nature revolts from it, experience condemns its use, and enlightened practice will ever withhold it, however importunate friends and relatives may be, through mistaken kindness, to induce a relaxation of that discipline which the judgment of the medical attendant leads him to enforce. According as disease declines, greater indulgence may, of course, be granted; but this consideration belongs to the medical treatment, and is discussed elsewhere. The present article professes only to specify what is meant by antiphlogistic regimen when it is enjoined by the medical attendant.

Air.—The time is happily gone by when febrile patients were immured in heated chambers, overwhelmed with blankets, a good fire maintained to prevent the risk of cold, and every aperture through which pure air could enter, even to the key-hole of the door, carefully closed. Absurd and almost incredible as this practice now appears, half a century has scarcely elapsed since it was generally followed. The febrile sufferer is now allowed to breathe a pure atmosphere, to ensure which is a most essential part of the antiphlogistic regimen. The intelligent practitioner, to whom the elements of physics should be familiar, can be at no loss to ascertain whether the circumstances of the invalid's chamber be such as to afford the necessary assurance of adequate ventilation. The confinement of air by closed bed-curtains is particularly pernicious, and should be utterly disallowed, the use of these being limited to averting direct currents, and moderating the glare of light. Even light should not be wholly excluded from the sick chamber, save where there is high excitement of the brain, or morbid sensibility of vision.

Temperature.—On this head it may suffice to state that the best medium temperature for a chamber is about 60° of Fahrenheit's thermometer. Circumstances may occasionally require it to be higher or lower. As sensation is a very imperfect measure of temperature, the best security is to adjust the heat by a thermometer suspended in the room.

Mental repose.—The observations made on bodily rest are all applicable to the state of the mind. Mental excitement is capable of disturbing all the bodily functions, and of exasperating every symptom of fever. Of ordinary exertion of mind the febrile patient is soon rendered incapable by the effects of disease, which speedily hebetate the mental energies. The morbid excitement of brain which results from its special derangement is itself a symptom of disease, and, as such, is the proper province of the medical attendant, who should direct the appropriate treatment; all ordinary excitement of mind of which the patient may be susceptible should be carefully restrained, or permitted only with extreme caution; perfect quiescence both of body and mind being that state which will best second the medical treatment. Indeed, it is the same principle which applies to both; for though in referring to mind the remarks are applied to the manifestations, the reasoning is really directed not to these, but to the physical state of the brain on which they depend, and which, under fever, is sensibly disturbed by whatever gives rise to much mental emotion.

The moral treatment of the invalid is, consequently, no unimportant part of antiphlogistic regimen.

E. Barlow.

ANTISEPTICS. See Disinfection.

ANTISPASMODICS (ἀντὶ, against, and σπασμὸς, spasm) are usually defined stimulant substances which allay irregular muscular contraction. In whatever manner muscular action takes place, it may be affirmed that it is altogether attributable to the nervous system; the nerves of motion being those engaged in it, whether the stimulus or exciting power be mental or material. The motion which is induced is transitory, and always followed by a state of rest; it is this alternation of motion and quietude, under due regulation, which constitutes the distinction between *ordinate* and *inordinate* muscular action. If, after muscles have contracted, they retain this condition when the exciting cause ceases to operate, they are said to be in a state of spasm, and such medicines as have the power of resolving this state are termed antispasmodics. If narcotics allay irritability, soothe pain, and produce diminished susceptibility to the impressions of exciting agents, it may reasonably be inquired in what respect antispasmodics differ from narcotics.

The chief circumstance in which antispasmodics differ from narcotics is, that the administration of the former is not followed by the insensibility to impressions, and collapse, which almost invariably follow the exhibition of narcotic substances. No such effects can be induced by antispasmodics, even in large doses; yet they are as powerful as narcotics in repressing inordinate muscular action. In explaining, therefore, the difference between antispasmodics and narcotics, we may hazard the opinion that it is probable the impression exerted on the extreme nerves by a narcotic is confined to those of sensation, and must be communicated to the brain before the effect is produced; whereas that caused by an antispasmodic is confined to the nerves of motion, and produces an immediate and more permanent result by some changes effected in the state of the motor nerves, independent of any communication with the sensorium. If this opinion be correct, antispasmodics, in the strict meaning of the term, stand in the same relative position to narcotics as astringents to tonics. But, whatever may be their mode of action, the distinct nature of an antispasmodic, acting simply as such, is very obvious; and antispasmodics may be regarded as holding an intermediate place between narcotics and tonics,—less diffusible but more durable than the former,—more immediate but less permanent than the latter. Another point requires consideration, viz., whether antispasmodics are to be regarded as stimulants or sedatives? If our hypothesis be correct, they have a sedative operation; for if the irregular or inordinate action, which they overcome, be the consequence of irritation, either mental or corporeal, it follows that, in resolving spasm, the susceptibility of impression in the extremities of the motor nerves must be diminished, and this can only be the result of a sedative power. It may, however, be affirmed that this may be either immediate, or the consequence of a previous stimulant operation: thence, we can explain the reason why some of these medicines which are direct antispasmodics stimulate the general system, and consequently quicken the pulse; since, like narcotics, their primary action may be stimulant, and quickly followed by collapse. According to this mode of reasoning, the same results may follow from the influence of the exclusive operation of antispasmodics on the nerves of motion, as *from* that of narcotics on those of sensation.

Antispasmodics, as far as regards their mode of action, may be divided into *direct*, or "those which exert their influence on the nervous energy, but neither as narcotics or tonics;" and *indirect*, or "those narcotics and tonics which produce an antispasmodic effect."

The effects of antispasmodics are generally perceptible very soon after their administration, more especially if the powers of the individual are weak. It should, however, be kept in mind that this class of remedies is of no avail, indeed is positively injurious when the spasmodic muscular action is the consequence of inflammation of the brain or spinal marrow: under such circumstances, blood-letting and other measures calculated to subdue the primary disease, are the proper measures to be adopted. It is necessary also to mention that the operation of antispasmodics is very transient, and that by frequent repetition their influence on the nervous system is much impaired; the dose therefore requires to be modified very much, according as the individual has or has not been accustomed to their employment.

The Materia Medica furnishes few direct antispasmodics. One of the most powerful, musk, is too expensive to be generally prescribed, particularly as the dose is required to be very large in order to obtain a satisfactory result from its employment. We can bear testimony to its powerful influence in diminishing the violence of the paroxysms of idiopathic epilepsy, and greatly lengthening the intervals, when the dose is carried to the extent of a drachm given at intervals of eight hours. It is most advantageously prescribed in the form of bolus: the mixture and the tincture of the Pharmacopœias being very uncertain preparations. Much less can be said in favour of castor, which is greatly inferior to musk as an antispasmodic.

Among the animal oils, that of Dippel, although much lauded on the continent, and notwithstanding its success in epilepsy in the hands of Alibert, may be regarded as an antispasmodic of little efficacy, and ought to be expunged from the list of Materia Medica. The oil of amber, also, formerly prized as a powerful antispasmodic, is now scarcely ever prescribed. Valerian, assafœtida, galbanum, and sagapenum, owe their antispasmodic properties chiefly to volatile oil, in combination with resin and extractive matter: their efficacy in hysteria, spasmodic asthma, and similar affections, has been well ascertained. Naphtha was formerly much employed as an antispasmodic in diseases unattended with inflammatory symptoms; and the West Indian practitioners still extol it in hooping-cough, and some other spasmodic diseases.

With respect to indirect antispasmodics, little is required to be said. In selecting them, we must be guided by the state of the patient, and the nature of the exciting causes of the spasms which we are called upon to relieve. If they are the result of local irritation, and kept up by habit after the removal of the irritating cause, narcotics are to be employed as the most powerful means of allaying irritation, and breaking the habit which has been acquired. But if the spasm is maintained by a peculiar susceptibility to impressions, which is always, more or less, connected with debility, then tonics are to be administered; and the more rapidly the body can be brought under their influence, the better.

Something may be expected to be said with regard to mental impressions as antispasmodics. There can be no doubt that some mental states produce and maintain spasmodic action in the body, while others as readily operate as powerful antispasmodics. As a minute consideration of this question, however interesting in itself, would exceed our limits, we shall merely allude to the power of *abstraction.* In every instance of spasmodic action, from whatever cause, the attention is directed to the part affected; so long as this exists, no corporeal agents which do not make a greater impression on the mind than that produced by the spasm, can resolve it: but when the attention is withdrawn from the spasm, it is instantaneously relaxed. Thus, a man has his shoulder-joint luxated; and, after various attempts, the luxation cannot be reduced on account of spasm which has supervened, and which is maintained by the attention of the patient being directed solely to the part; but abstract the attention, and the spasm instantly yields, and the head of the humerus slips into the socket. In the same manner, and with the same success, the antispasmodic influence of abstraction has been experienced in hernia and other diseases; in its application, however, great judgment and nice discrimination are requisite.

In reference to the practical employment of antispasmodics, their utility is confined to one order of diseases only, the spasmi. In tetanus, the narcotic antispasmodics, particularly opium and camphor, have been much employed; but neither these nor the direct antispasmodics, musk, oil of amber, or assafœtida, have fulfilled the anticipations of practitioners. The most powerful is, undoubtedly, opium; and it is almost incredible what doses of this remedy may be administered in this disease; fifteen and twenty grains have been given every three hours, for eight and ten days successively, with little effect upon either the disease or the constitution of the patient. When opium has proved beneficial, its effects have been rarely obvious until after the tenth or twelfth day of its exhibition; but indeed we may safely affirm that little reliance is to be placed upon the influence of the most powerful antispasmodics, direct or indirect, in this disease.

[The *Cannabis Indica* or *Indian Hemp* has been recommended, by Dr. O'Shaughnessy, of Calcutta, as an "anti-convulsive remedy" of the greatest value; and when given boldly, and in large doses, as a successful remedy in traumatic tetanus. (Pereira, *Elements of Mat. Med.*, 2d edit. p. 1096: Lond. 1842; and Dunglison's *New Remedies*, 4th edit. p. 133: Philad., 1843.)]

In chorea, when purgatives have failed to procure relief, antispasmodics, such as musk, opium, and belladonna, have been freely administered; but in this disease more decided benefit has been obtained from tonics operating as antispasmodics than from either narcotics or musk. Much advantage has resulted from the use of the nitrate of silver, the carbonate of iron, and arsenious acid; all of which operate as indirect antispasmodics. It is true, that, in some cases in which these tonics have failed, the disease has yielded to the use of musk and camphor; but, in general, less advantage has been derived from the employment of direct antispasmodics, than, from the nature of the disease, might have been reasonably anticipated.

Antispasmodics effect little good in epilepsy. Some of the narcotics have sometimes appeared to prove useful; but we have seen them all frequently fail in relieving this disease. Among the indirect antispasmodics, the preparations of zinc, copper, mercury, and arsenic, have each had a transitory reputation; but if any of the metallic tonics merit confidence, it is the nitrate of silver, which operates by diminishing the susceptibility to those impressions that produce irregular action.

In asthma, at least in one form of it, antispasmodics have been found highly beneficial. Assafœtida among the direct, and opium and stramonium among the indirect antispasmodics, have been found capable of accomplishing every thing to be expected from this order of remedies in that affection. It is singular that in this country opium should not have been smoked, in the manner in which the Chinese employ it, for the relief of spasmodic asthma; as the same circumstances which render stramonium serviceable when smoked are likely to render opium still more so; and the experiment is worthy of being tried. In hooping-cough, the direct antispasmodics have been little employed; but some of the indirect, for example, belladonna and conium, are much to be relied upon. Our experience in the use of the extract of belladonna enables us to offer the following directions for its administration. Supposing a child of five years of age to be the object of hooping-cough,—after administering an emetic and purgative, a pill containing one-tenth of a grain of extract of belladonna may be given every fifth hour; and the dose gradually increased, until the sight be affected, and a scarlet efflorescence closely resembling the eruption of scarlatina appears on the skin. Whilst this state continues, the cough is often suspended; and by maintaining it for some time, both the violence of the paroxysms is abated, and the continuance of the disease greatly shortened. The adjunct which we have found most beneficial is the hydrocyanic acid, in doses of one minim, administered in any convenient vehicle; but it should be generally known that the efficacy of the extract is destroyed by alkaline solutions.*

In colic, the benefit to be expected from antispasmodics depends much upon the exciting causes of the attack. In simple constriction of the intestines, narcotics will answer every indication intended to be fulfilled; but when flatulence is the exciting cause of the spasmodic constriction, assafœtida and the direct antispasmodics will be found serviceable; and, when there is constipation, calomel and aperients must be joined to the antispasmodics. Opium, in such cases, tends rather to augment than to impede the operation of purgatives, although the extract of hyoscyamus is frequently preferred.

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* A fact ascertained by Professor Runge. *Ann. de Chimie*, tom. xxvii. p. 32.

In no disease have antispasmodics more satisfied the anticipations of the practitioner than in hysteria. [It is the only disease, in which, at the present day, direct antispasmodics are much used.] In this affection the convulsions are of the most severe description. During the paroxysm, the direct antispasmodics, especially assafœtida and valerian, have been found very useful, when prescribed in sufficient doses, which is rarely the case; for, as we have already said, little benefit can be expected unless the doses be much larger than those usually prescribed. During the intervals, the metallic tonics should be chiefly relied upon as antispasmodics; and, indeed, it is only by endeavouring to correct the morbid susceptibility existing in these cases that any permanent benefit can be expected.

Upon the whole, the range of the order of antispasmodics is extremely circumscribed; at best, the different substances can be regarded as auxiliaries only. Spasm is to be regarded rather as the result of causes which are to be removed, than as a circumstance for which remedies are to be directly administered.

[It would seem, that all the *direct* — and such only can be esteemed *true* antispasmodics—must produce their effect by virtue of the new impression which they make on the olfactory and gustatory, or on the gastric nerves, or on both; thus deriving from the inordinate action in some other part of the nervous system. All the direct antispasmodics are, indeed, well calculated to effect this derivation. Most of them, as assafœtida, castor, Dippel's oil, valerian, and skunk-cabbage, being exceedingly offensive, and at the same time possessed of excitant properties. In ordinary cases of spasm, not dependent upon an excited state of vessels, anything, therefore, that will produce a new nervous impression may prove antispasmodic. Narcotics do so by blunting the impressibility of the nervous system; nauseous agents produce their effects upon the olfactory or gustatory nerves; and, if they be excitants at the same time, upon the nerves of the stomach. Certain highly nervous and imaginative persons can feel pains wherever they please; and many an individual, by the perusal of cases of disease, has fancied himself affected with the same sufferings which he has seen depicted. If, therefore, attention can direct the nervous afflux to a part, it is obviously of great moment so to impress the nervous system of the individual, that no concentration of the kind may take place towards the suffering organ; and this may be effected by engaging the mind, in light cases, on some subject of entertainment or reflection; in stronger cases, by impressing the totality of the nervous system, as by narcotics; or by affecting nerves at a distance from those implicated, as by the direct antispasmodics more especially. (Dunglison's *General Therapeutics and Materia Medica*, i. 396: Philad. 1843.)]

A. T. THOMSON.

AORTA, ANEURISM OF THE. The aorta, in common with the other arteries of the body, is liable to aneurismal disease, the anatomical characters of which are comprehended under the four following varieties: —

1st.—*Dilatation*, which is an enlargement of the whole circumference of the artery.

2d. — *True aneurism*, which is a sacculated dilatation of a portion only of the circumference, or of one side of the artery.

3d. — *False aneurism*, which is formed by ulceration or rupture of the internal and middle coats, and expansion of the external or cellular into a sac. It is called *primitive*, when all the coats are directly divided, as by a wound; and *consecutive*, when it is consequent on ulceration or rupture of the internal and middle coats.

4th. — *Mixed aneurism*, which is a supervention of false upon true aneurism, or upon dilatation; that is, after dilatation, either partial or general, of all the three coats, the internal and middle burst, and the external alone expands into a further sac, surmounting the original dilatation or true aneurism.

FORMATION AND ANATOMICAL CHARACTERS OF THE SEVERAL SPECIES OF ANEURISM.

1st. Dilatation, or enlargement of the whole circumference of the Aorta.—When the coats of the aorta, whether from inflammation or from any other morbid action, have become diseased, they lose their elasticity, a quality which resides principally in the middle tunic. As fluids press equally in every direction, the blood propelled by each contraction of the heart into the aorta, exerts not only a longitudinal, but a lateral force, which expands the vessel, and constantly tends to enlarge its caliber. The elasticity of the arterial walls enables the vessel to resist this expansive force, and to regain its previous caliber after the diastole. Consequently, when the elasticity is impaired or lost, the vessel, not being able to regain its original dimensions after each diastole, becomes permanently dilated; and this takes place to a greater or less extent, and with greater or less promptitude, in direct proportion to the predominance of the distending over the resisting force.

It very rarely happens that a dilated aorta does not present, in its interior, some of the morbid changes already described, (see ARTERITIS); namely, cartilaginous, steatomatous, atheromatous, or calcareous depositions, with a thickened, wrinkled, and fragile state of the internal coat. When such depositions are not apparent, the walls, according to our observations, are always more or less indurated, opaque, and inelastic; and are sometimes extenuated, particularly the middle coat, and sometimes thickened, with a softened and easily separable state of the internal coat: a condition of parts which is a much more natural cause of dilatation than paralysis of the middle coat, supposed by some authors to be its cause when no depositions were manifest.

The ascending portion, and arch of the aorta, particularly the latter, are by far the most frequent seats of dilatation; but the descending portion, both in the chest and abdomen, is sometimes affected, and the dilatation is then either uniform throughout the whole length of the vessel, or it consists of one or even a series of ovoid or fusiform expansions. The side of the artery adherent to the spine, and the lesser curvature of the arch, yield less readily than the other parts. Dilatation of the aorta does not, in general, exceed twice the natural caliber of the vessel, but we have occasionally seen it attain three, or even four times that size. When such is the case, it frequently presents many minor bulgings or pouches, which give it a considerable resemblance to the transverse arch of the colon. The walls of these pouches are often extenuated and semi-transparent from horn-like and calcareous depositions, and it is here more especially that mixed aneurism is apt to take place; for the brittleness of depositions causes rupture of the internal and middle coats, and the engraftment of false aneurism upon the true.

Dilatation of the pulmonary artery is extremely rare. We have met with one remarkable case in which it was enlarged to four inches and a half in circumference. Dilatations, even though pouched, scarcely ever contain laminated coagula; for the surface is, in general, too smooth to arrest the blood. When they do take place, it is in consequence of an ulcerated or fissured state of the internal membrane, which forms nuclei for the adhesion of fibrine.[*] The coagula thus formed occasionally fill up the whole of the dilated portion, and leave the canal of the artery of its natural caliber.

The great arterial trunks rising at right angles from the aorta, as the innominata and cœliac, generally participate in the dilatation: the left subclavian almost always remains exempt; without doubt, says Laennec, on account of the acute angle at which it branches off. Dilatation takes place not only in the aorta and its immediate trunks, but sometimes in smaller and more remote arteries, as, for example, the carotid by the side of the sella turcica, the temporal [†] and emulgent [‡] with their ramifications, the arteries of the extremities, and those feeding tumours of any description, particularly fungus hæmatodes and the hæmorrhagic nævus or aneurism by anastomosis of John Bell.

2d. True Aneurism, or lateral partial dilatation of the Aorta.—True aneurism differs from dilatation in the circumstances, that it is an enlargement of a limited portion only of the circumference of the aorta; that it generally rises with an abrupt margin; and that its neck is, in most cases, narrower than the body of the sac. Its formation is to be attributed to a loss of elasticity, and, consequently, of resistance, in the particular part only that dilates; and the proofs of its existence consist in the possibility of tracing the internal and middle coats of the artery throughout the whole extent of the expansion, and in the presence within the sac of those morbid appearances which are peculiar to the internal coats of arteries, such as calcareous, cartilaginous, and atheromatous depositions, with slight fissures, and small red spots. These proofs have, of late years, been so frequently verified by dissection, that the reality of aneurism by dilatation of all the coats of an artery is no longer problematical. Almost all the aneurisms of the ascending portion and arch are originally of the true species, but the false is sometimes engrafted upon them. The tumour generally springs from the anterior or the lateral part of the vessel, while the posterior part is little, if at all implicated: it sometimes attains the magnitude of a mature fœtal heart,[§] and generally inclines to the right side of the chest. When it springs from the root of the aorta, and the middle and internal coats happen to burst, there results, not a false aneurism surrounding the true, as in other parts, but a fatal extravasation into the pericardium. The reason of this is, that the part of the aorta referred to is destitute of the cellular tunic, and the pericardium which supplies its place, not being equally extensible, bursts, rather than dilates into a false aneurism. In the same way the deficiency of the cellular coat in the arteries of the brain causes their rupture to be followed by an apoplectic extravasation, instead of by the formation of an aneurismal sac. It has been stated by a recent writer that a preparation in Mr. Hunter's collection subverts the doctrine that false aneurism does not form at the root of the aorta. The preparation of which he speaks, however, is not one of *false* aneurism, as the middle coat is perfect, the internal one alone being diseased, or removed, (it is doubtful which,) at the base of the sac. It has not been denied by authors that *true* aneurism may form at the root of the aorta. We have ourselves seen it in more than one instance. Coagula are occasionally, but not often, found in true aneurisms; they are usually in masses, adherent by a peduncle, and seldom in layers investing the walls unless the aneurism is very large; the reason of which is, that the mouth of the sac being in general spacious, the blood has a sufficiently free ingress and egress to circulate with force, while the surface of the sac is so smooth as not to arrest the fibrine, and cause its deposition in layers. But when the circulation is by any cause enfeebled, the blood stagnates and forms coagula in masses, which become adherent by limited portions or peduncles. True aneurism is much more rare than either false aneurism or dilatation.

3d. False Aneurism, or Aneurism by ulceration of the internal or middle Coats.—Nichols proved, by experiments made before the Royal Society of London, that, when the internal and middle coats of an artery are divided, and water or air is forced into the vessel, the external coat distends so as to form a small sac, (Philos. Trans. vol. xxxv. p. 443.) In the same manner, when the internal and middle coats are perforated by ulceration or a fissure, the blood, by its lateral pressure, gradually raises the external coat, and expands it into a sac, which communicates with the interior of the artery, whose caliber is not enlarged, by a narrow aperture or neck. As the distension proceeds, the external coat itself gives way, and the sheath of the vessel next opposes the effusion of blood; finally, when this also yields, the contiguous parts, whatever be their texture, contribute to the formation of the sac, they having previously undergone thickening and agglutination by chronic adhesive inflammation, to which distension had given rise. Such is the manner in which the sac is formed in aneurism from ulceration of the arterial coats. It presents no vestige of the middle or fibrous coat, nor the depositions connected with the internal membrane; but its inner surface is extremely rugged and unequal from lymph irregularly deposited by inflammation. To this rugged surface adhere the layers of fibrine subsequently deposited by the blood.

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[*] *Burns*, on Diseases of the Heart, p. 206. *Bertin* and *Bouillaud*. Case xxxvi.

[†] *Cruveilhier* Essai sur l'Anat. Patholog. Paris, 1815, t. ii. p. 60.

[‡] Journal de Médecine par MM. Corvisart, Leroux, et Boyer, tom. vii. p. 255.

[§] *Corvisart*, Journal de Médecine, par MM. Corvisart, Leroux, et Boyer, t. vii. p. 355. Laennec de l'Auscult. t. ii. p. 691.

Perforation of the internal and middle coats is not always followed by aneurism of the kind described. Laennec met with a case in which the internal and middle coat had been divided by a narrow transverse fissure extending over two-thirds of the circumference of the artery; and the blood, instead of distending the external coat into a sac, had insinuated itself between it and the fibrous, and dissected them from each other over upwards of half the circumference of the artery, from the arch of the aorta to the common iliacs, (De l'Auscult. tom. ii. p. 700.) Fissures of the kind described result from cracks or lacerations occasioned by calcareous depositions; but the case of Laennec, and two similar cases mentioned by Mr. Guthrie, (*Guthrie* on the Diseases of Arteries, p. 40 and p. 43,) are the only instances within our knowledge in which a fissure has been followed by more than a circumscribed effusion of blood around it, occasioning a slight swelling of the external coat. Nichols found this in the body of George II., (Philos. Trans. vol. lii. p. 269;) and Hodgson once met with it, (On Diseases of Arteries, p. 63.)

The late Mr. Shekelton has described, in the Dublin Hospital Reports, vol. iii., another and previously unnoticed kind of aneurism; namely, the blood had forced its way through the internal and middle coats, dissected the middle from the external or cellular for the space of four inches, and then burst again through the internal and middle coats into the canal of the artery; thus forming a new channel, which eventually superseded the old one; the latter having become obliterated by the pressure of the tumour.

[The term **Dissecting Aneurism** was given by Laënnec to this form. Many such cases are now on record. Dr. Pennock (Amer. edit. of Hope *on Diseases of the Heart*, p. 408, Philad. 1842,) refers to four that have occurred in the observation of American pathologists. In all these, the lesion was identical; — the separation of the laminæ of the middle coat, by blood driven by the propulsive force of the heart through a rent caused by a laceration of the serous coat, and a partial rupture of the layers of the middle coat. From the examination of these pathological specimens, and from the fact that the attachment of the external fibres of the middle coat to the cellular is much firmer than that of the layers of the middle coat between themselves, Dr. Pennock is induced to believe that dissecting aneurism, when it occurs to any extent, will be found to be *between the laminæ of the middle coat*, and not between the middle and the outer coats of the artery. An excellent paper by Mr. Peacock on this form of aneurism is contained in the *Edinburgh Medical and Surgical Journal* for Oct. 1843.)]

The causes of perforation of the internal and middle coats, and the formation of false aneurism, are,—1. *ulceration*, generally occasioned by the detachment of calcareous incrustations, by atheromatous depositions under the internal membrane, and, more rarely, by tubercles, or small abscesses in the substance of the fibrous tunic: 2. *rupture*, or *cracking*, which takes place when the tunics have been deprived of their elasticity by cartilaginous, steatomatous, fungous, and calcareous degeneration.* The immediate or exciting cause of the rupture is generally some violent exertion or accident; and in most instances patients with aneurism date it from some occurrence of this kind. Rupture does not appear ever to take place in a perfectly sound artery; and if it did, the experiments of Dr. Jones prove that it would not be followed by an aneurism, as an effusion of lymph takes place, which strengthens the vessel in the lacerated part, (*Jones* on Hemorrhage, p. 125.)

While aneurism of the ascending aorta and arch are, in the first instance, almost invariably true, though they occasionally become mixed, those of the descending aorta are generally false; and the caliber of the artery is, with few exceptions, not in the slightest degree dilated opposite to the tumour. Aneurism by perforation of the internal and middle tunics is the only species of which Scarpa admits the reality; but the inaccuracy of his opinions has been fully proved, and, as before stated, there is no longer any question respecting the actual existence of aneurism by dilatation of all the coats. The cases of false aneurism that are on record are very numerous. Reference may be made to the works of Lancisi, Morgagni, Guattoni, Scarpa, Desault, Warner, Hodgson, Home, Laennec, Bertin, and Bouillaud.

4. **Mixed Aneurism, or false Aneurism surmounting true.**—This species is formed in the following manner. All the three tunics of the artery first undergo an expansion, which, according to its form, constitutes either a dilatation or a true aneurism: as the expansion proceeds, the internal and middle tunics burst, and the external, being more extensible, dilates into a sac, surmounting the original enlargement. Aneurisms of this description are very numerous. Whether the cyst succeeding a perforation of the arterial walls has been preceded or not by their dilatation; in other words, whether the aneurism is *true* or *mixed*, it communicates with the cavity of the aorta by an aperture more contracted than its body, and circumscribed by a prominent border, corresponding with a kind of strangulation. This disposition of parts has been perfectly described by Scarpa, and admirably represented in his plates.

GENERAL OBSERVATIONS ON ANEURISMS OF THE AORTA.

Haller and MM. Dubois and Dupuytren have remarked a variety of aneurism, in which the internal membrane makes a hernia through the ruptured fibrous coat, and lines the sac, which is formed by the external or cellular coat. Hernia of the internal membrane may occur, according to Laennec, in very small aneurisms: he had seen it in two, which were not larger than cherries; but when the tumour increases, the internal membrane speedily bursts. This he found to have been the case in two other aneurisms which did not exceed the size of walnuts, (De l'Auscult. tom. ii. p. 693.) The experiments of Mr. Hunter, Scarpa, and Sir E. Home prove, that when the external and middle coats of an artery are removed, the internal one does not dilate into an aneurism, but either bursts, or is strengthened by granulations arising from its surface, and by adhesions formed with the surrounding parts.

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* *Scarpa* on Aneurism, § 20, 21, 22. *Laennec* de l'Auscult. tom. *ii.* p. 704. *Hodgson*, p. 62.

Corvisart having found several firm, solid tumours, of the size of nuts, intimately adherent to the aorta, while the external and middle coats appeared to be deficient at the point of attachment, was led to imagine that *extraneous* tumours, for such he conceived them to be, becoming adherent to arteries, led to the formation of aneurism, (Essai sur les Maladies du Cœur, p. 313.) Hodgson, on the contrary, regards the tumours in question as instances of aneurism cured, the sac having been *filled* up by lamellated coagula, (On Diseases of Arteries, p. 127,) and the volume of the tumour diminished by absorption; and Laennec, Bertin, and the best authorities subscribe to his opinion.

As an aneurismal sac enlarges, the surrounding parts become involved in its composition. Thus the bones, muscles, and various other structures, often contribute to its formation. The viscera, also, become implicated when the tumour is situated in their vicinity; and the membranes with which they are invested being distended to their utmost, finally yield, and the sac bursts into their cavities. Accordingly, aneurisms frequently prove fatal by discharging their contents into the lungs, œsophagus, stomach, intestines, bladder, &c. The size which the tumour attains depends upon the nature of the surrounding parts, and is very much determined by their extensibility — a property which is almost in direct proportion to the quantity of cellular tissue of which they are composed. Hence it is that, when the disease is situated at the root of the aorta, where the pericardium supplies the place of the more extensible cellular coat of the vessel, the sac bursts into the pericardium before it has attained any great magnitude. Hence, also, it is that, in the cranium, where the arteries are destitute of the cellular coat, and are ill supported by the pia mater and the soft pulpy substance of the brain, aneurism is extremely rare; for such a lesion of the coats of the arteries as would elsewhere give rise to aneurism, is here attended with rupture and apoplectic effusion. It has been already stated, however, that the arteries of the brain are not insusceptible of dilatation.

One of the first circumstances that almost invariably follows the formation of true aneurism is, the deposition of the fibrine of the blood upon the internal surface of the sac. This deposition takes place in successive concentric layers, which have a different aspect according to the date of their formation. The most central consist simply of blood more or less firmly coagulated, and they are probably formed subsequent to death; a little farther the coagulum is drier, paler, and evidently composed of a large proportion of fibrine: still farther are layers of pure, whitish, yellowish, or greyish fibrine; and, finally, in contact with the walls of the cyst, are layers of the same matter, but completely opaque, of a somewhat friable consistence, like dryish paste, and very closely resembling flesh which has been deprived of its colour by boiling. The most recent layers adhere to each other so slightly as almost to float within the sac; those beneath are united by a flossy or nappy cellular tissue, the adhesion being stronger in proportion as the layers are older. Patches of vivid red, formed by reticulated blood-vessels, are occasionally found in the fibrine, and blood often penetrates between its layers, and stains those which are friable, or decomposed. Coagula are softer in some cases than in others, though the physical circumstances be the same in both. The difference is probably owing to a difference in the chemical qualities of the blood. From these anatomical characters it is evident that lamellated coagula form by the successive depositions of the fibrine of the blood; and the depositions are accounted for by the stagnation of the blood within the sac; for it is proved, by experiment and observation, that coagulation of this liquid takes place whenever its course is interrupted; hence the polypi that are found in the heart, the great veins, and the arteries, when the circulation through those parts is obstructed. The coagulation of blood within a false aneurism is favoured by two circumstances, the narrowness of the aperture of communication with the artery, and the ruggedness of the interior of the sac. In true aneurism, as has already been stated, the width of the aperture of communication, and the smoothness of the interior of the sac are unfavourable to the coagulation, and accordingly fibrinous *layers* are very seldom found in those aneurisms, unless they are of great size, although they often contain coagula in masses attached at one part only by a peduncle of greater or less thickness. The thickness of fibrinous depositions within aneurisms is sometimes very great. Most commonly it is from half an inch to an inch and a half, but we have seen it exceed three inches: it is generally greater on one side of the sac than another. Laennec has seen fibrinous coagula as compact and diaphanous as horn softened to the utmost by heat, and of a thickness exceeding five inches' breadth.

Aneurisms, and the diseases of the coats of arteries which precede their formation, are much more frequent in men than in women. Of sixty-three cases seen by Hodgson, fifty-six occurred in the former, and only seven in the latter. (On Diseases of Arteries, p. 87.) We have found the proportion rather larger in females with respect to aneurism of the aorta, but with respect to external aneurism it is much smaller, perhaps not exceeding one in fifteen to twenty.

[In the winter of 1843–4, Dr. Dunglison had an opportunity of exhibiting to the clinical class of the Philadelphia Hospital the morbid appearances presented in three cases of internal aneurism:— two of the aorta, and one of the internal iliacs— which occurred in the wards under his charge. The subjects were all females.]

EFFECTS OF ANEURISMS OF THE AORTA ON THE CONTIGUOUS PARTS.

The effect of aneurisms of the aorta on the contiguous parts vary according to the volume, the form, and the position of the tumour. Dilatation, when not very considerable, produces little derangement of the surrounding parts; for as the swelling is equable and diffuse, it does not exert a pressure on any one organ in particular, and its magnitude is not such as to create much inconvenience from general infarction. The worst of its effects are those which it produces on the trachea and great bronchi; for though the pressure be slight, it often suffices, in consequence of the great irritability of these parts, to occasion considerable dyspnœa. It must not, however, be imagined that dilatation is an unimportant affection: it will hereafter be shown that, when complicated with enlargement of the heart, which it generally brings on, it is one of the most formidable diseases incident to the circulatory apparatus.

An aneurism which forms a defined tumour, whether it be of the true or the false species, and whether it be large or small, may produce the most pernicious effects. These are,—

1st. Such as result from compression of the neighbouring parts.

2d. Such as result from their destruction.

1st. By compression, the functions of the lungs, bronchi, heart, and œsophagus, are deranged, and that sometimes to a fatal extent. In the abdomen the functional derangements are comparatively inconsiderable, and very rarely endanger life. The reason of this is twofold,—first, that the abdominal organs are not of so vital a nature as the thoracic; and secondly, that the tumour, instead of being pent up in a rigid bony case like the chest, is permitted, by the yielding of the intestines, and the distensibility of the abdominal parietes, to expand freely in almost every direction. Pressure on any particular organ, therefore, is in a great measure obviated by the want of counter-pressure—of a fulcrum. Ventral aneurism, however, sometimes deranges the respiration by preventing the due descent of the diaphragm; an effect which may proceed either from the magnitude alone of the tumour, or, what is much more common, from its being seated near or in the substance of the muscle, and impeding its motions. Ventral aneurism is also occasionally characterterized by involuntary evacuation of the urine and fæces, by remarkable alternations of constipation and diarrhœa, and by deep-seated excruciating pains, resembling those of lumbar abscess. These symptoms arise from compression of the nerves, particularly the hypogastric plexus around the aorta.

2d. The consequences of destruction of contiguous parts are far more formidable than those resulting from compression. When the tumour exerts an unusual pressure on any organ or texture, adhesive inflammation takes place and unites the parts in contact. As the pressure increases, absorption and ultimately perforation of the sac ensue, and death from internal hemorrhage is the immediate consequence. The perforation takes place either by sloughing, or by laceration, according to the nature of the membrane or texture perforated. Thus, when the tumour advances to the skin, or when it extends into a cavity lined by a *mucous* membrane, it bursts by the separation of a slough which has formed upon its most distended parts, and not by laceration. On the contrary, when the sac projects into a cavity lined by a *serous* membrane, sloughing of the membrane does not take place, but the parietes of the tumour, having become extremely thin in consequence of distension, at length burst by a crack or fissure, through which the blood is discharged. An aneurism may burst into a great variety of parts, which we shall notice in succession.

When the lungs are in contact with the tumour, adhesion, absorption of the sac, and rupture of the pleura take place, and the effused blood deluges the bronchi and causes suffocation. It often happens that an aneurism of the ascending aorta, or arch, compressing the trachea, or one of the great bronchial trunks, opens its way into it by ulceration of the cartilaginous rings and sloughing of the mucous membrane, and causes suddenly fatal hæmoptysis. More rarely, perforation takes place into the œsophagus, and death then ensues from hæmatemesis. Aneurisms occasionally burst at the origin of the aorta, and cause death by effusion of blood into the pericardium. The fatal event, however, is not always so sudden as in the preceding cases; a circumstance which Laennec attributes to the pericardium being supported, and the effusion, consequently, restrained, by the general infarction of the chest, occasioned by the presence of the tumour. This reason appears to us unsatisfactory, because, as before explained, aneurisms at the root of the aorta generally burst before they attain any considerable magnitude: nor, if large, would the resistance offered by the atmospheric pressure in the lungs, equal the force with which the blood tends to escape into the pericardium — a force equal to the propulsive power of the left ventricle. It is, perhaps, more probable that the inextensibility of the pericardium beyond a certain point, and the resistance of the heart to compression, form the principal powers which limit the effusion of blood. It would appear that life is sometimes protracted for a considerable period after the rupture of the sac; for in specimens presented to the Société de la Faculté de Médecine by M. Marjolin, the margins of the aperture, according to Laennec, were polished, as if of old standing, and, as it were, fistulous. (*Laennec*, Opt. Cit. ii. p. 715.) Rupture into the pericardium is very rare. Laennec never met with an instance. The first that has fallen under our own observation occurred recently at St. George's Hospital. Morgagni (Epist. xxvi. Nos. 7, 17, 21) and Scarpa, (On aneurism, § xix. p. 103, et sequent,) however, have collected together a considerable number of these cases, and Hodgson saw two, in which the aneurism, beginning half an inch above the semilunar valves, occupied the whole ascending aorta and arch.

Aneurisms have been known, but very rarely, to burst into the pulmonary artery. MM. Payen and Zeink saw an instance, (Bulletin de la Faculté de Médecine, 1819, No. 3,) and Dr. Wells another.* Professor Monro, tertius, showed us a preparation of an aneurismal pouch springing from the aorta, directly against the pulmonary artery; and it is probable that, if the patient's life had been prolonged, rupture would have taken place into the artery. The left cavity of the pleura and the posterior mediastinum are the parts into which thoracic aneurisms most frequently burst. It is extremely seldom, on the contrary, that they open into the right pleura. Laennec has seen an aneurism of the descending aorta, which had compressed and destroyed the thoracic duct, and produced engorgement of all the lacteal vessels. Aneurisms sometimes compress the descending vena cava, and cause cerebral congestion, œdematous intumescence of the face, and even apoplexy. We have met with several instances of this kind. Corvisart,* and Bertin and Bouillaud, (Traité des Maladies du Cœur, p. 137,) each cite a case of apoplexy thus occasioned.

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* Trans. of a Society for the Improvement of Med. Chirurg. Knowledge, vol. iii. p. 85.

Another effect of aneurisms is to obliterate arteries springing from or contiguous to them. We have met with two cases in which both the left carotid and subclavian were plugged up at their origin from the tumour. The obliteration is sometimes *effected*, not by a plug of lymph, but by contortion or compression of the vessel. Mere contraction of the origin of arteries from these causes is very common. Ventral aneurisms may open their way into the various abdominal viscera, as the intestines, the bladder, &c.

Aneurisms not only cause destruction of the soft parts, but, what is still more remarkable, erosion of the bones. This phenomenon has been variously explained. The old pathologists erroneously ascribed it to a chemical solvent power of the blood. Hunter, Scarpa, and Hodgson, thought that it resulted from absorption of the earthy matter, in consequence of the pressure of the sac. Corvisart and Laennec attribute it to a sort of detrition or wearing down, produced by a purely mechanical action. Bertin and Bouillaud believe that it is more or less dependent on inflammation. To us it appears that absorption and mechanical *detrition* are the principal agents concerned in producing the effect. That pressure is capable of exciting absorption of bone is certain, as the vertebræ have been found excavated by an aneurismal tumour, without being divested of their periosteum (*Hodgson*, p. 79.); and there can scarcely be a doubt, that, when a denuded bone is exposed to the constant dashing of a column of blood, it undergoes disintegration by the mechanical detachment of its particles. Whether inflammation ever contributes to the effect, is difficult positively to determine. Appearances, however, are adverse to this opinion, as pus has never been found on bone eroded by an aneurism; as exfoliation scarcely ever takes place; and as nothing is discovered on it analogous to the cicatrization or irregular reproduction which is observable in other bones when affected with caries. Cartilage, whether exposed to the action of the blood in aneurismal sacs, or to the pressure alone of the tumour, either remains entirely uninjured, or suffers incomparably less than bone. This is most manifest in the intervertebral substance, and the cartilages of the false ribs. The circumstance is attributable to the elasticity of cartilage, which protects it from mechanical disintegration, and to its almost inorganic structure, which renders it little susceptible of absorption or ulceration. The bones liable from their position to be eroded by aneurism, are the vertebræ, the sternum, the ribs, and sometimes the ossa ilii.

It is principally by aneurisms of the descending aorta that the vertebræ are injured. In these cases the portion of the sac in contact with the vertebræ is entirely destroyed, and its borders adhere very firmly around the eroded part of the bone, on which the blood plays freely in consequence of the fibrinous layers having been absorbed at that part. The destruction is sometimes so deep that the shell of the vertebræ forms the only partition between the sac and the spinal canal. Very rarely, however, does rupture take place into the canal. We are not aware that there are more than two instances on record, one by Laennec in the Révue Médicale for 1835, and another of which the preparation, by Mr. Chandler, is in the Hunterian Museum.

Ventral aneurisms seldom produce erosion of the bones; because the abdominal viscera and walls yield to the tumour.

It is by aneurisms of the ascending aorta that the sternum and ribs are eroded, and the tumour generally presents on the right side. Aneurisms of the arch and the innominata project at the upper part of the sternum, and about the clavicles, which they have been known to dislocate at their sternal extremities. When the tumour is connected with the posterior part of the arch, it shows itself underneath the left clavicle. According to Hodgson, when the periosteum contributes to the formation of the sac, its vessels continue to secrete an earthy matter, which, in some instances, has been deposited to such an extent as to form a considerable portion of the tumour.

Small aneurisms have the effect of destroying the bones in a greater degree than large; a circumstance attributable to the greater concentration of the pressure exercised by them.

SIGNS AND DIAGNOSIS OF ANEURISMS OF THE AORTA.

The signs of aneurism of the aorta are of two classes.

1. General signs.
2. Signs afforded by auscultation, percussion, &c.

These two classes of signs will first be described separately, and a brief summary then given of the signs of the two classes conjointly, which refer to the several forms of aneurism.

I. General signs of aneurism of the aorta.

When an aneurism is buried deep in the chest, and not capable of being detected by the sight and touch, it does not present a single general sign which is peculiar to itself, and, therefore, pathognomonic of its existence. There are even cases in which it occasions no functional derangement—no inconvenience whatever; and the first circumstance that unveils the truth is, the sudden death of the patient while apparently in the enjoyment of perfect health. We have met with six or seven instances in which large aneurisms had existed without awakening even a suspicion in the mind of the medical attendant. One, in particular,

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[*] Journal de Médecine, par MM. Corvisart, Leroux, et Boyer, tom. xii. p. 150.

eluded the penetration of a distinguished foreign auscultator, though he explored the lungs with eminent success. We are acquainted with only one general sign of aneurism of the thoracic aorta which is unequivocal and certain, namely, a tumour presenting externally, and offering an expansive as well as heaving pulsation, synchronous with the action of the heart. Of the remaining general signs, a large class are identical with those of organic disease of the heart, viz. palpitation, dyspnœa, cough, tendency to syncope, terrific dreams, starting from sleep, hæmoptysis, livid or otherwise discoloured complexion, cerebral or hepatic congestions, serous infiltration, &c. This identity arises from an identity of cause; namely, an obstacle to the circulation, which depends either upon the aneurism alone, or conjointly upon it and a disease of the heart, to which, sooner or later, the aneurism almost invariably gives birth. It is obvious, therefore, that the signs of this class are equivocal. There are, however, certain other general signs which are more characteristic: yet even these are of themselves ambiguous and unsatisfactory; as they only bespeak lesions of the viscera, or derangement of their functions, but do not proclaim the latent cause of the mischief. But when they coincide with the signs derived from auscultation, they lose their ambiguity, and rise into real importance; for the two classes of signs, general and stethoscopic, are a commentary on each other, and reciprocally borrow a precision and certainty of which they are individually destitute. We shall succinctly describe the general signs to which we refer, and subjoin to each the principal sources of fallacy. The means of detecting the latter we shall point out in the final summary.

1. When the tumour has attained a considerable magnitude, the cavity of the chest is preternaturally crowded, and the patient complains of a sense of constriction, infarction, and oppression. But these sensations are common to almost all diseases of the chest.

2. The radial pulses are sometimes dissimilar, or one is extinct; an effect dependent on obstruction or obliteration of the arteria innominata, or left subclavian. But the difference of the two pulses at the wrist may proceed from a variety of causes independent of aneurism of the aorta, as, contraction of the origin of either subclavian from osseous, cartilaginous, steatomatous, or other deposition; obstructions in the course of the artery, occasioned by tumours, wounds, subclavian aneurism, &c.; an irregular subdivision of the humeral, brachial, or radial artery. We have known the most ludicrous surmises occasioned by the radial crossing to the outside at the middle of the fore-arm, and the superficialis volæ supplying its place at the wrist.

3. When the origin of either subclavian is contracted, the pulse at the corresponding wrist is a little later than the ventricular systole. We have not found this symptom uniformly present. The heart is more frequently its source than the aorta, and we have observed it to be most considerable in cases of regurgitation into the left auricle; but obstruction of the aortic valves may occasion it in a minor degree, particularly if this lesion is accompanied with extenuation or atony of the ventricular parietes. When the sign exists in both pulses, the presumption is strong that its source is in the heart.

4. According to Corvisart, a purring tremor — the *frémissement cataire* of Laennec — is sometimes perceptible to the hand at the middle or upper part of the sternum, and indicates aneurism of the ascending aorta. Purring tremor, above the clavicles, is an almost constant concomitant, and therefore a valuable sign, of dilatation of the arch; but, according to our experience, it is unfrequently and imperfectly occasioned by sacculated aneurisms, especially if lined by strata of lymph. We have never known the tremor to be occasioned below the clavicles by dilatation, unless the enlargement was so great as to extend beyond the lateral margins of the sternum, and allow the tremor to be felt through the intercostal spaces: but we have met with one case in which a dilatation of the pulmonary artery, though not voluminous, afforded a marked tremor between the cartilages of the second and third ribs on the left side: this, however, is not remarkable, as the artery *naturally* lies nearly opposite to the part described. We have never known a sacculated aneurism create a tremor below the clavicles, unless the tumour had eroded the bones of the chest, and presented externally underneath the integuments.

But the purring tremor may be occasioned in any part of the chest by mucous rattles, particularly those of the snoring kind, in the large bronchial tubes; and we have observed that, when derived from this source, it is a very common cause of deception, in reference both to aneurisms of the aorta and ossifications of the heart. Purring tremor of the pulse is regarded as a sign, though it is a fallacious one, of ossification of the aortic valves. From many dissections, it has appeared to us to be generally connected with two circumstances, viz. a powerful action of the heart, and ruggedness, without appreciable obstruction, of the aortic orifice, or interior of the vessel. It, therefore, seldom exists, unless either the action of the heart be accelerated, or the left ventricle be hypertrophous.

5. When the trachea, or primary bronchial divisions, are compressed by an aneurismal tumour, a harsh wheezing, or sibilous sound, proceeding deep from the throat, characterizes the respiration; the voice is either croaking or reduced to a whisper, or it is a compound of both; the breathing is often extremely laborious, and when the heart is simultaneously diseased, dyspnœa sometimes occurs in paroxysms of the most suffocating severity. When the œsophagus is compressed, deglutition of solids is rendered difficult, and sometimes impracticable; for the descent of the morsel excites an excruciating pain from the summit of the sternum to the spine, or lancinating deeply in every direction through the chest.

But compression of the trachea, or œsophagus, with the above symptoms, may be occasioned by tumours of any description. Wheezing respiration may proceed from an accumulation of glutinous mucus in the great branches. We have likewise known it produced in an extreme degree by laryngitis with thickening of the soft parts covering the arytænoid cartilages, and also by ossification and ulceration of the larynx from strumous, syphilitic, and mercurial disease. So difficult is it to distinguish the seat of wheezing respiration, that it has in many instances been imputed to an affection of the larynx, when it was in reality occasioned by an aneurism of the aorta; and bronchotomy has several times been actually performed with the view of obviating suffocation.

6. When the vertebræ are eroded, the patient suffers an intense terebrating pain in the spine; and when the brachial plexus of nerves is compressed by the tumour, an aching sensation pervades the left shoulder, neck, scapula, and arm, with numbness, formication, and impaired motive power of the limb. But I have met with cases in which nearly similar pains were experienced, although there was no destruction of the vertebræ: and it is common to hear individuals affected with rheumatism or spinal diseases make the same complaints. The affection of the arm may be occasioned by various forms of organic disease of the heart, and it thus constitutes a part of that concatenation of symptoms which are denominated angina pectoris. We have likewise often met with it in hysterical females subject to palpitation, and occasionally in cases of pericarditis. In all these cases the pain probably originates in irritation of the cardiac plexus of the sympathetic, propagated to the brachial plexus.

7. When, in consequence of an adhesion between the aneurismal sac and the pleura, the blood plays upon the lungs, a sense of ebullition is said to be experienced. But the same symptom is familiar to individuals labouring under phthisis, or chronic mucous catarrh; and it proceeds from the successive bursting of large bubbles, formed by the transmission of air through the fluid in tuberculous caverns, or in the greater bronchial ramifications.

8. It occasionally happens that the patient suffers excruciating pain from a spasm, pursuing the course of the diaphragm, and binding the chest around, as with a cord. This symptom is too vague to be important, and it also occurs in hysteria, gastrodynia, colic, spinal diseases, and rheumatism of the diaphragm.

9. A pulsation is felt underneath the sternum, or ribs, at the superior part of the chest. This, although one of the least equivocal signs of aneurism, is not without ambiguity. It may be occasioned by a tumour of any description, as an enlarged gland, or a cancer, interposed between the sternum and the aorta, and receiving the pulsation of the latter. Even Dr. Baillie says, "But we are not to conclude from this symptom (viz., pulsation at the superior part of the chest) that there is certainly an aneurism. I have felt the same kind of pulsation in other cases; as, for instance, where the pericardium was found strongly to adhere to the heart; where there was a slight inflammation upon the surface of the heart, with a little more water than usual in the pericardium; and where a morbid enlargement had taken place in the heart, without any aneurismal swelling." Every one much conversant with disease must have made the same observations.

10. A pulsation is felt above the sternum or clavicles. But this may be occasioned, 1st. by enlarged glands or other tumours seated on the subclavian artery, and receiving its pulsation; 2d. by varix of the jugular vein at its junction with the subclavian; both of which conditions have deceived expert practitioners; 3d. by subclavian aneurism. This affection sometimes resembles aneurism of the aorta so exactly, that it is extremely difficult to distinguish them. Allan Burns records a case in which all the eminent surgeons of the district were unanimous in pronouncing the affection subclavian aneurism, yet it proved to be aortic. (Surg. Anat. of Head and Neck, p. 30.) Sir Astley Cooper has published a number of similar cases, and one is mentioned by Professor Monro tertius. (Elements of Anat. vol. ii. p. 249.) 4th. A pulsation above the sternum or clavicles may be occasioned by carotid aneurism. This, also, may readily be confounded with aneurism of the aorta, or of the subclavian artery. In April, 1826, we saw a case at Guy's Hospital, which led to much deliberation respecting the propriety of taking up the carotid above a pulsating tumour, supposed to be an aneurism of that artery. It was finally decided that the tumour was too low, and the design was judiciously abandoned. The affection proved to be a dilatation of the aorta and arteria innominata. The carotid was sound. This state of parts was indicated to us by the stethoscope. Mr. Hodgson met with a similar case. (On the Diseases of Arteries, p. 90.)

11. The superior and middle parts of the chest are dull on percussion. But this sign is common to an infinity of other diseases, and the resonance is seldom impaired unless the aneurism be very large.

It cannot be a subject of surprise that a series of symptoms liable to so many fallacies, should have proved insufficient, without the aid of auscultation, to dissipate the deep obscurity involving the diagnosis of aneurisms of the aorta. We have next to consider the second class of signs, namely,

II. Signs of aortic aneurism afforded by auscultation, percussion, &c.

The investigations of M. Laennec on aneurism of the thoracic aorta, were limited and inconclusive. Accordingly, he remarks that, "Of all the severe lesions of the thoracic organs, three alone remain without pathognomonic signs to a practitioner even in auscultation and percussion,—namely, aneurism of the aorta, pericarditis, and concretions of blood in the heart previous to death.

"Taking the part of auscultation against its immortal discoverer," we hope to show that there is now little difficulty in the diagnosis of the three affections in question. We shall first present the opinions of Laennec, and then offer the results of our own observation.

Laennec's opinions respecting the stethoscopic signs of aneurism of the aorta are as follows:— On applying the cylinder, in two instances, to tumours presenting externally, he found that their pulsations were exactly isochronous with the pulse; that the shock and sound greatly exceeded those of the ventricles; that the beating was distinctly audible on the back; and that the auricular sound could not be distinguished at all. For the last reason he denominated the aneurismal pulsation *simple*, in contradistinction to that of the heart, which has a double sound, in consesequence of the alternate systole and diastole of the ventricles.* From these two cases he felt certain that, in some instances, pectoral aneurisms might be recognised by the *simple pulsation*, usually much stronger than that of the heart; but he thought that, in a larger proportion of cases, the sign would be insufficient, for, as the slightest dilatation of the heart renders its sounds audible over the whole sternum, and even below and along the clavicles, he imagined that, under such circumstances, the first or systole sound of that organ would be confounded with the sound of the aneurism, with which it is synchronous; while the second, or diastolic sound, being audible as far as the tumour, would lead the auscultator to suppose that he there heard the beating of the heart, and not that of the aneurism. We shall presently show that this reasoning is incorrect. As the auricular sound is not audible over the abdomen, Laennec found no difficulty in recognising ventral aneurisms by the *simple pulsation*.

According to our experience, the cylinder is scarcely less capable of affording decisive indications of pectoral than of ventral aneurism. It is unimportant whether the pulsations be "*simple*" or "*double;*" for, though double, they may be distinguished from the beating of the heart by unequivocal criteria: viz.—

1st. The first aneurismal sound, coinciding with the pulse, is invariably louder than the healthy ventricular sound, and generally than the most considerable bellows-murmurs of the ventricles.

2d. On exploring the aneurismal sound from its source towards the region of the heart, it is found to decrease progressively, until it either becomes totally inaudible, or is lost in the predominance of the ventricular sound. Now, if the sound emanated from the heart alone, instead of decreasing it would increase on approximating towards the præcordial region.

3d. The second sound actually does sustain this progressive augmentation on advancing towards the heart; and, as its nature and rhythm are found to be precisely similar to those of the ventricular diastole heard in the præcordial region, it is distinctly identified as the diastolic sound. The second sound, therefore, corroborates rather than invalidates the evidence of aneurism afforded by the first; for if both sounds proceeded from the heart, both would, on approximating towards it or receding from it, sustain the same progressive changes of intensity.

4th. Another distinctive characteristic of the aneurismal pulsation is the peculiar nature of its sound. It is a deep hoarse tone, of short duration, with an abrupt commencement and termination, and generally louder than the most considerable bellows-murmurs of the heart. It accurately resembles the rasping of a sounding-board heard from a distance; whereas the sound occasioned by valvular disease of the heart has more analogy to the bellows-murmur, being somewhat soft and prolonged, with a gradual swell and fall. It appears probable that the greater hoarseness and loudness of the aneurismal sound above than below the clavicles, is attributable to its being reverberated through the chest before it arrives at the ear. This probably is countenanced by the following considerations:—(*a.*) That, in several cases with which we have met,† although the sound above the right clavicle was loud and hoarse, it was merely a whizzing (*sifflement*) without hoarseness on the superior part of the sternum, where the dilated ascending aorta was in apposition with the bone, and where, consequently, the sound was transmitted immediately to the ear. (*b.*) That, in the heart, the proximity of which organ to the thoracic parietes is unfavourable to the expansion and reverberation of its sounds, morbid murmurs are less hoarse and loud than those occasioned by pectoral aneurisms. (*c.*) That in aneurisms of the abdomen and extremities, where there is little or no reverberation of sounds, there is a still less degree of hoarseness and loudness.

The abruptness of the aneurismal sound, compared with the prolonged swelling character of the ventricular murmur, is owing to the latter being generated by a gradual muscular contraction, while the former is due to the sudden prepulsion of a fluid through a tube naturally very resistant, and rendered still more unyielding by disease. The loudest aneurismal sound is that occasioned by dilatation, and it has more of the grating or rasping character in proportion as the interior of the vessel is more overspread with hard and especially osseous asperities. When the dilatation is confined to the ascending aorta, the sound, impulse, and purring tremor are stronger on the right than on the left side of the neck; and the sound along the mesial part of the sternum—the tract of the ascending aorta—is superficial, and of a whizzing or hissing character. Old aneurisms, the parietes of which are thickened by fibrinous depositions, yield only a dull and remote sound. In all cases of dilatation, and in the majority of sacculated aneurisms, the sound is loudest above the clavicles, even though the impulse be stronger below. In some cases of the sacculated species it is louder on the side of the neck opposite to that where the tumor exists. We have found this to proceed from one or other of two causes—first, disease of the inner coat of the aorta before or beyond the tumor; secondly, the interposition of the sac, thickened with fibrinous layers, between the aorta and the super-clavicular region, in consequence of which the source of sound,—the mouth and cavity of the sac,—was unusually remote on the side occupied by the tumor.

The sound of aneurisms is, in most instances, audible on the back; and when the tumor occupies the descending aorta, and is extended along the spine, it is often louder behind than on the breast. If it possesses on the back the abrupt rasping character, the evidence which it affords is almost positive; for the loudest sounds of the heart, when heard on the back, are so softened and subdued by distance, as totally to lose their harshness.

5th. *Purring* tremor is another characteristic of the aneurismal pulsation. It is more considerable in simple dilatation than in sacculated aneurism, particularly if the former be accompanied with much asperity of the internal membrane. From numerous dissections, the fact appears to us to admit of the following explanation:—in cases of dilatation, the interior of the vessel is almost invariably rendered rugged by osseous, cartilaginous, or other adventitious depositions; and the blood, in permeating such a tube, necessarily occasions a strong tremor, as its particles are thrown into preternatural commotion and collision, not only by the enlargement of the caliber of the vessel at the dilated part, by which they are diverted from their direct course, but also by the roughness of the surface over which they have to pass. In sacculated aneurism, on the contrary, though a portion of blood descends into the sac, the greater quantity pursues a direct and tranquil course through the smooth canal of the artery, and the tremor is therefore less considerable.

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* It is necessary to remind the reader that the systole of the auricles was regarded by Laennec as the cause of the second sound; but, according to the experiments and researches of the writer, the diastole of the ventricles is the cause of that phenomenon. Vide *Lond. Med. Gaz. Aug.* 1830, and a Treatise on the Diseases of the Heart, by the writer, 1831.

† See, for instance, Case 9, *Lond. Med. Gaz.* September 18, 1829.

We have uniformly found the purring tremor confined to the superclavicular regions, except in the case of aneurisms which had protruded through the ribs, and presented immediately underneath the integuments. *It is rarely occasioned at all by old aneurisms; because, in consequence of their magnitude and the thickening of their sacs with fibrinous coagula, they possess little susceptibility of vibration.*

Purring tremor, proceeding from organic disease of the aorta, may easily be distinguished from that occasioned by nervous agitation. The former is constant, or may be excited at pleasure, simply by accelerating the circulation; it is restricted to a limited space above the sternal extremities of the clavicles, and is accompanied with the hoarse aneurismal sound. Nervous purring tremor, on the other hand, is only occasional, occurring when there is an exacerbation of nervous excitement and restlessness; it extensively pervades the adjoining arteries, and the concomitant sound is comparatively soft and feeble.

Pulsation attends every species of enlargement of the aorta. In dilatation, it exists only above the sternal ends of the clavicles, and always on both sides of the neck simultaneously; though, when the enlargement is confined to the ascending aorta, it is stronger on the right than on the left side. When dilatation is of a pouched form, and of great magnitude, it may occasion pulsation under the sternum. Of this we have met with instances. Carotid and subclavian aneurisms produce impulse, sound, and tremor, on the affected side only, and by this circumstance they may easily be discriminated from aortic enlargements.

In sacculated aneurism seated in the upper parts of the chest, pulsation exists both above and below the clavicles; but I have generally found it stronger below. When the tremor is large, and occupies the left extremity of the arch, the impulse is often perceptible from the sternum to the left shoulder, and as low down as the third or fourth rib. When it lies in contact with the ribs posteriorly, the shock is sometimes felt on the back. This, however, is a rare occurrence. A pulsation under the sternum or ribs is one of the least ambiguous signs of sacculated aneurism.

Summary of the stethoscopic, in conjunction with the general, signs of aortic aneurism.

Simple dilatation of the arch, and ascending aorta. Stethoscopic signs.—1st. A constant pulsation above both clavicles at their sternal ends; stronger on the right side if the enlargement is confined to the ascending portion, and never communicated to the sternum or ribs unless the dilatation is enormous. 2. A hoarse rasping sound above both clavicles, of brief duration, commencing and terminating abruptly. If the enlargement is confined to the ascending portion, the sound is louder above the right than the left clavicle, and along the middle of the sternum it is superficial, and of a hissing or whizzing character; by which, and by the sound being situated higher up the chest, it is distinguishable from that of valvular disease. It is usually distinct on the back, where the ventricular sounds, if audible at all, are very obscure. 3. A purring tremor above the clavicles, but never below. It is stronger, and the concomitant sound is more grating, in proportion as the interior of the aorta is more overspread with hard and especially osseous inequalities.

General signs of dilatation. Frequently none. When any exist, they are a slight degree of those common to all organic diseases of the heart, viz. the signs of an embarrassed circulation. They assume a most aggravated aspect when dilatation becomes complicated with organic disease of the heart.

Fallacies, and methods of detecting them.

(*a.*) *Nervous arterial excitement and reaction after loss of blood*, sometimes occasion an impulse and bellows-sound above the clavicles; but they may be discriminated by the impulse being feeble, and the sound more hissing or whizzing than in aneurism of the aorta, and by the absence of purring tremor. It is, in fact, in the subclavian arteries that the phenomena take place; for though the aorta be under the same excitement, its action is not so violent as to extend in any appreciable degree to the supra-clavicular regions.

(*b.*) *Adhesion of the pericardium*, particularly when accompanied with hypertrophy of the heart, we have, in many instances, found to occasion the impulse and whizzing sound above the clavicles in a still more remarkable degree than nervous excitement. The phenomena depend upon the suddenness, and, as it were, spasmodic energy of the ventricular contraction. They may be distinguished by the sound being more whizzing and less hoarse, and the impulse more jerking, than in dilatation of the aorta; and they should always be suspected to proceed from adhesion, when the heart presents the signs and the history affords the presumption of that affection.

(*c.*) *Dilatation of the pulmonary artery* is a third, though extremely unfrequent, source of fallacy: for the mode of detecting it we refer the reader to the next head, viz.

Dilatation of the pulmonary artery.—We have met with one case in which this artery was dilated to the extent of five inches in its internal circumference. It presented the following signs.

1. A pulsation with purring tremor between the cartilages of the second and third ribs on the left side, and thence in a decreasing degree downwards, but not appreciable above the clavicles. Also a slight prominence between the same ribs.

2. An extremely loud, superficial, harsh, sawing sound, audible above the clavicles and over

the whole præcordial region, but loudest on the prominence between the second and third ribs.

General signs were those of hypertrophy and dilatation of the heart, with which the dilatation of the pulmonary artery was complicated.

Fallacies, and the methods of detecting them.

Dilatation and aneurism of the aorta are perhaps the only affections for which dilatation of the pulmonary artery could be mistaken. The signs, however, of the latter are so characteristic, that, with due attention, it is scarcely possible to commit an error. Thus, a pulsation between the cartilages of the second and third ribs could not be occasioned by a dilatation of the ascending aorta; as this artery, even when dilated, is too far to the right to extend beyond the margin of the sternum. Again, a sacculated aneurism of the ascending aorta could not reach the cartilages of the second and third left ribs without being very large, and in this case it would form a much greater tumour externally than existed in the present instance. The sound also of such an aneurism would be dull, and as if remote, instead of loud and superficial. Finally, either a dilatation or an aneurism of the aorta would occasion a greater pulsation and sound above one or both clavicles, than existed in the case of which we speak.

Sacculated aneurism of the thoracic aorta.—Stethoscopic signs. 1. A pulsation both above and below the clavicles, but usually stronger below. If the tumour occupies the ascending aorta, its impulse is most perceptible on the sternum, and towards its right. If it is seated in the arch or commencement of the descent, the pulsation inclines to the left side, and sometimes reaches to the shoulder. It is occasionally perceptible on the back. In front, the pulsation is always stronger on the tumour than at some point intermediate between it and the heart, and generally stronger than the impulse of the heart itself.

2. The aneurismal sounds described under dilatation, but weaker. In large, old aneurisms, it has a dull and remote character, and is sometimes louder on the side of the neck opposite to that where the tumour is situated. It is generally audible on the back; and when the tumour occupies the descending aorta, it is often louder behind than in front. If, on the back, it has more of the abrupt, rasping sound than the ventricular systole in the præcordial region, the evidence of aneurism is almost positive.

3. A purring tremor above the clavicles. We have never found it below, unless the tumour had penetrated through the ribs or sternum. It is weaker than in dilatation, and in old and large aneurisms often becomes extinct.

General signs of sacculated aneurism.—Any or all of the following signs may be present. A pulsating tumour, presenting externally, and sooner or later causing livid redness of the integuments; deficient resonance on percussion; a sense of retraction of the trachea, with a wheezing respiration and croaking or whispering voice; dysphagia; an intense gnawing or boring pain in the spine; aching of the left shoulder, scapula, neck, axilla, and arm, with numbness, formication, and impaired motive power of the limb; a sense of weight and infarction in the chest; difference of the two pulses; purring tremor of the radials; some or other of the ordinary symptoms of organic disease of the heart.

Fallacies, and the methods of detecting them.

Pulsation beneath the sternum and ribs, occasioned by amplified glands, or other tumours in the anterior mediastinum, by hydropericardium, by enlarged heart, or, finally, by adhesion of the pericardium, may, according to our experience, be easily discriminated from aneurismal pulsation by the following criteria.

(*a.*) *Pulsating glands*, or other tumours in the anterior mediastinum, are not attended with the aneurismal sound; and symptoms of a disturbed circulation either do not exist at all, or do not correspond in severity with the magnitude of the apparent disease. (*b.*) *Hydropericardium*, instead of producing the gradual, steady, and powerful heaving of an aneurism, occasions an undulating motion, of which some of the shocks are stronger than others, and none are exactly synchronous with the sound of the ventricular systole. The motion is equally diffused over every part of the space occupied by the fluid; whereas in aneurism the impulse is notably stronger on the tumour and on the heart, than on the intermediate space. Hydropericardium is not productive of the aneurismal sound. Its history is different from that of aneurism, the latter being very often referred to some injury or excessive exertion, suddenly followed by pain or dyspnœa. (*c.*) *An enlarged heart* causes a pulsation over a preternatural extent in every direction; an aneurism occasions it in its own direction alone. The beating of an enlarged heart is strongest at the point nearest to the centre of motion, and it decreases progressively on receding from that centre: the beating of an aneurism is stronger on the tumour than at some point intermediate between it and the heart; and in most instances it is stronger even than the beating of the heart itself. Hence, an aneurism distinctly conveys the impression of their being two centres of motion—the tumour and the heart; while the pulsation of an enlarged heart is felt to be referable to one alone. Finally, the ventricular contraction of a dilated heart produces a loud flapping sound, and is not attended with aneurismal murmur or pulsation above the clavicles. We have never known adhesion of the pericardium to occasion a pulsation which could be mistaken for an aneurism, until it had occasioned enlargement of the heart, its ordinary consequence. In this case the diagnostic symptoms are the same as those of enlargement of the heart, with one difference, that the motion is of a more unsteady, undulating, and struggling character, (*d.*) *Varix of the jugular vein*, occasioning pulsation above the clavicle, is distinguished by the absence of sound, the compressibility of the humour, and the languor of the impulse. (*e.*) *Enlarged glands*, or other tumours above the clavicles, receiving pulsation from a subjacent artery, rarely occasion sound; and if any exist, it is a feeble whizzing. Both it and the pulsation are confined to the side affected. If the tumour can be grasped, it will be felt not to dilate laterally during the ventricular contraction; and if it can be raised from the subjacent artery, its beating will cease entirely. (*f.*) *Subclavian and carotid aneurism* occasion pulsation, sound, and purring tremor on the affected side only, and these signs are more superficial and distinct than in aneurism of the aorta. The sound resembles that of the small hand-bellows, instead of having the hoarseness of the forge-bellows. (g.) *Purring tremor* of the chest, proceeding from mucous rattle, may be recognised by its ceasing when respiation is suspended.

Sacculated aneurism of the abdominal aorta is comparatively so easy of detection, that we have not thought it necessary to enter into detail respecting its signs.

Stethoscopic signs.—1. A constant pulsation of extraordinary power. It appears much stronger to the ear resting on the stethoscope than to the hand. The instrument may be forced down in various directions into close proximity with the tumour, and an idea of its position and dimensions may be thus obtained. 2. A loud, brief, and abrupt bellows-sound, not so hoarse as that of aneurisms in the chest. It is sometimes audible on the back. The diastolic sound of the heart is inaudible, and, consequently, the pulsation is simple.

General signs.—They are those of impeded respiration dependent on an imperfect descent of the diaphragm; of lumbar abscess, with or without caries of the vertebræ; of renal disease; and of pressure on the nerves or viscera of the abdomen and pelvis; but none are pathognomonic of aneurism, except a pulsating and usually compressible tumour, felt through the abdominal parietes.

Fallacies, and methods of detecting them.

(*a.*) *A scirrhous tumour* of the stomach. (*b.*) *Enlargement of the pancreas* by hydatids, or scirrhus—an extremely rare affection. (*c.*) *Fungoid, or other tumours* of the mesentery, omentum, transverse arch of the colon, or diaphragm. (*d.*) *Indurated fæces*, air, or masses of tapeworm, impacted in the transverse colon. When any of these tumours rest upon the aorta, they receive its pulsation, and frequently occasion a bellows-sound by compressing the vessel. They may be discriminated from aneurism by their impulse being comparatively feeble, particularly when the stethoscope is applied laterally; by the sound being only a slight whizzing; by the tumour feeling incompressible; by its being superficial when connected with the stomach, colon, or omentum; and by its moving with the movements of these viscera. Finally, the general symptoms are those of dyspepsia, or of malignant disease, with slow and progressive marcor, without derangement of the circulation. (*e.*) *An accumulation of serum* in the peritoneal cavity is another source of fallacy, as the liquid transmits both the impulse and the sound of the aorta more distinctly than natural. Dr. Young made this discovery in 1815.[*] As it is easy to detect the fluid, we have never found this source of fallacy to occasion the least embarrassment.

Nervous pulsation of the abdominal aorta.—This is a very frequent and deceptive affection in irritable and hysterical constitutions. When it exists in conjunction with air pent up in the colon or duodenum and presenting the feel of a compressible tumour, the resemblance to aneurism is still more complete. After an examination of many cases, we are satisfied that attention to the following circumstances will render the diagnosis easy. The cylinder may be pressed down on the aorta so as to yield a distinct feel of the vessel of its natural caliber. The sphere of its pulsation is limited transversely, but extensive longitudinally; being usually more or less perceptible from the epigastrium to the bifurcation. The impulse, instead of being the gradual, steady, and irresistible heaving of an aneurism, is a smart, though vigorous jerk; and the sound, when any exists, is merely a whizzing, almost devoid of hoarseness. The general symptoms are nervous or hysterical, and the pulsation is of an inconstant character, increasing and diminishing with the exacerbations and remissions of the constitutional excitement.

SPONTANEOUS CURE, AND MEDICAL TREATMENT OF ANEURISM OF THE AORTA.

Previous to entering upon the treatment of aneurism of the aorta, we shall explain the mechanism by which its spontaneous cure is effected, as the reader will thus be better enabled to understand the principles on which the treatment is founded.

The movement of the blood within the sac being retarded, partly by the roughness of its internal surface, and partly by the fluid being withdrawn from the direct channel of the circulation, coagulation takes place, and lymph is deposited and organized in successive strata, until the cavity is at length completely filled. The sac, being then no longer exposed to the distensive pressure of the circulation, tends to contract by its own resilience and the compression of the incumbent parts, absorption of its contents takes place, and the aneurism is finally reduced to a small, dense, flesh-like tumour. In arteries of the second and inferior orders, the coagulum generally extends to and obliterates the caliber of the vessel itself;[†] but this is rarely the case in the aorta, as the force of the circulation in so great a vessel prevents the lodgement of coagula. Instances, however, of obliteration of the aorta by lymph are not without example. An important case has been published by our friend Professor Alexander Monro,[‡] and Dr. Goodison describes another.

It is principally in false aneurism that the cure by deposition of coagula takes place. In true aneurism, and in dilatation, such a cure is very rare; for the walls being unbroken and smooth, and the aperture of communication with the sac being in general large, the blood is seldom arrested to such a degree as to deposit lamellated coagula. When, however, the whole circumference of an artery is converted into a bony cylinder, there is a great tendency to its obliteration by a plug of lymph. Dr. Goodison's case was of this description; and we have more than once witnessed the same in arteries of the second order.

Hence, as the formation of coagula within the sac is the principal means employed by nature in effecting the cure of aneurisms, the primary object of medical treatment is to promote the deposition of coagula; and this is best accomplished by such means as have the greatest effect in enfeebling and retarding the circulation. Accordingly, the antiphlogistic treatment, rigorously pursued, is the most efficient remedy for aneurism of the aorta. This has acquired great celebrity under the designation of the treatment of Albertini and Valsalva. By detraction of blood and spare diet, they reduced their patients to so extreme a state of debility, that they were scarcely able to raise their arms from the bed. Morgagni reports (Epist. xvii. art. 30.) that when Valsalva had taken away as much blood as was requisite, he made it a custom to diminish the quantity of meat and drink more and more every day, till he proceeded so far as to allow only half a pound of pudding in the morning, and in the evening half that quantity, and nothing else except water, and this also within a certain weight. After he had sufficiently reduced the patient by this method, so that, from weakness, he could scarcely raise his hand from the bed, in which he lay by Valsalva's order from the very beginning of the disease, he increased, by degrees, every day, the quantity of aliment until the necessary strength returned.

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[*] Med. Trans. of Coll. of Phys. of London, vol. v. 1815. No. 15.

[†] Vide *Hodgson*, *Jones*, *Farre*, *Baillie*, *Petit*, *Desault*, and *Scarpa*.

[‡] Observations on Aneurism of the Abdominal Aorta, by *Professor Monro*, ed. p. 5 and 8, 1827.

To render this treatment safe and efficient, several circumstances must be taken into consideration. In persons of very feeble constitution, its employment is inadmissible, as it might be fatal by inducing other diseases, or irremediable debility. In individuals sufficiently strong to undergo the treatment, but in whom there is reason to apprehend that extreme debility, if long continued, might occasion pernicious effects, this state, when once induced, should be speedily removed. The depleting system should be actively pursued in the first instance, so as to make a decidedly enfeebling impression on the circulation, and thus allow of the contraction of the sac and the deposition of a coagulum; but when the pulse and general feelings of exhaustion indicate that the impression has been made, its protracted continuance should be prevented by a spare, but nutritious diet, as a little strong beef-tea or mutton-broth. The quantity of blood to be drawn must depend upon the constitution of the patient and the effect produced. In one case under our care, ℥x. were abstracted for sixteen days consecutively, with an excellent result. Others we have seen bled to ℥x. or xii., twice a day, for six or seven days; and this practice was pursued by Pelletan* and others; but we have found the best effect to be produced with the least expenditure of blood by drawing a considerable quantity, as from ℥xv. to xxv., in the first instance, and repeating the bleeding to ℥x. or xv., within twelve hours, and then taking ℥vi. or viii., every six or eight hours, or at such intervals as to prevent the establishment of re-action—a phenomenon, which, by producing an inordinate energy of the circulation, counteracts the effect of the depletion. Of this we can entertain no doubt, both from extensive observation on the human subject, and experiments on dogs; in the latter of which we have seen bleeding, repeated daily or every second day for ten days, occasion the most violent arterial throbbing.† In individuals who have not sufficient constitutional vigour to give rise to much re-action, less frequent and more sparing detractions of blood will suffice, as, for instance, from ℥vi. to xii., two, three, or four times a week. The blood after repeated abstractions becomes very serous, of a pale crimson instead of the natural dark venous colour, and has sometimes a whitish cream on its surface after standing twelve hours.

In aneurism of the aorta, especially when conjoined with organic disease of the heart, the bleeding should never, if possible, be carried to syncope, as, in such cases, this phenomenon is apt to be alarmingly protracted, and sometimes to terminate fatally. The blood, therefore, should be drawn slowly, and in the recumbent posture. Nor should the venesection be performed during a paroxysm of palpitation, as the exhaustion consequent on it, superadded to that occasioned by the loss of blood, not unfrequently sinks the patient beyond the possibility of restoration. When there is much pain in the tumour, leeches afford great relief to it, while they, at the same time, conspire to reduce the circulation; but they should not be applied when the integuments are very thin and discoloured, as they are apt to induce sloughing and rupture of the sac. Ice, as an application to the tumour, has been strongly recommended; but the pain which it produces, is, in general, intolerable beyond a short time. Its occasional use, however, and, in the intervals, a cold cataplasm of linseed-meal and vinegar, are very serviceable, by contracting all the tissues and promoting the coagulation of the blood within the sac, when its current has been rendered languid by depletory measures. When cold applications are not employed, and the tumour is painful and requires support, we have found the emplastrum belladonnæ afford the greatest relief.

The diet should consist principally of fluids, and it should be gradually reduced. Pelletan sometimes allowed only two basins of broth in twenty-four hours, and lemonade as a common drink. Valsalva, as before stated, gradually reduced the food to half a pound of pudding in the morning, and a quarter of a pound in the evening, with a limited quantity of water. By thus gradually reducing it both in quantity and quality, the solids may easily be brought as low as four ounces, and the fluids as eight, daily. In some even less is sufficient, and this for weeks together. Both the body and the mind should be kept in a state of the most perfect quietude. The recumbent position should be constantly maintained. Purgatives which have a great effect in weakening the action of the heart, should be frequently administered. Digitalis is useful by producing the same effect; but it should not be pushed so far as to bring the patient strongly under its influence, as the syncope induced by this drug is liable, in affections of the heart and aorta, to be fatal. We have several times seen it extremely alarming.

The well-known effect of the superacetate of lead in controlling active hemorrhages, has introduced this as a remedy for aneurism. In Germany it has been extensively used for many years, and Dupuytren, Laennec, and Bertin have employed

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[*] Clinique Chirurg. tom. i. Prem. Mém. sur les Anevrismes, p. 54.

[†] This subject has been developed with great ability, by *Dr. Marshall Hall*, in concert with whom we performed the experiments alluded to.

it with advantage in France. Our own experience is in its favour. Its tendency to produce colic, and inflammation of the mucous membrane of the stomach and intestines, may be counteracted by conjoining it with opium, and commencing with a small dose. Half a grain of each, gradually increased to a grain of the acetate in a pill, three or four times a-day, is the form in which we employ it. Any gastric irritation from it we have always found to be removed by a dose or two of castor-oil promptly administered, and mucilaginous diluents. When the patient has been reduced as low as the constitution will bear, the state of the aneurism should be examined with the utmost attention. If it has undergone no amelioration, the treatment should be abandoned rather than the risk incurred of reducing the patient further, and beyond the power of the constitution to sustain. But if it is clear that the pulsation and sound of the aneurism are greatly diminished or entirely suppressed, and the volume of the tumour reduced, the practitioner is justified in persevering,—so far as he can do it without bringing the life of the patient into palpable danger. When the amelioration has become confirmed, the treatment should be gradually relaxed, but abstinence and the recumbent position should be enforced, even for a considerable period after all the symptoms have disappeared.

The treatment of Albertini and Valsalva should not be adopted in a rigorous manner, and with a curative view, unless the practitioner has reason to believe that the aneurism is of the false species, viz. by rupture of the arterial tunics; or, if of the true species, that the sac is not a mere pouch, but so deep, and with so narrow a neck as to be considerably removed from the direct current of the circulation. The latter state may be presumed with some confidence when the tumour, supposing it to spring from the ascending aorta, extends far to either side; or, whatever be its situation, when its base is remote from the caliber of the artery. Aneurisms of the descending aorta may be treated as false: post-mortem inspection having proved that they are almost always of that description. In cases of dilatation, and of shallow true aneurism, the antiphlogistic plan should be pursued to a moderate extent only, and merely with a palliative object: for as, under such circumstances, coagula scarcely ever form, a radical cure is not to be expected.

It may be said, finally, that the efficacy of the treatment of Albertini and Valsalva has, in all probability, been somewhat over-rated. For, as the diagnosis of aneurisms of the aorta was involved in much obscurity until the last few years, it is certain that many cases, reported as cured, were not aneurisms, but tumours or nervous pulsation simulating that disease. Another reason has prevented the treatment from maintaining its ground, namely, its severity. Though patients will submit to rest and extreme abstinence, they have rarely fortitude to see bloodletting superadded. The practitioner, on the other hand, has seldom the courage to insist upon it, knowing that it is not wholly exempt from danger, and that it will not infallibly be productive of a cure, especially if not pursued with uncompromising rigour.

Treatment of nervous pulsation of the aorta.—Though the treatment of nervous pulsation does not strictly come under the head of aneurism, yet, as the pulsation is a frequent concomitant of aortic aneurisms and organic diseases of the heart, it may not be foreign to our present purpose to advert briefly to its treatment.

The indication is, to allay the nervous irritability and excitement on which the pulsation depends. This may be effected by causing the patient to maintain, as far as possible, a tranquil state of body and mind; by a mild cooling diet and regular state of the bowels; by sedative remedies, as conium, hyoscyamus, camphor mixture; and by these conjoined with antispasmodics, as assafœtida, valerian, sulphuric æther, if there be hysterical symptoms. It is scarcely necessary to add, that attention to the catamenial secretion is of primary importance. When the patient is sufficiently tranquillized to bear tonics and stimulants, the best remedies are the various preparations of steel, with infusions and decoctions of cinchona, cascarilla, columba, orange-peel, &c., the shower-bath, much out-door exercise short of fatigue, and a nutritious but not heating diet.

J. HOPE.

[AORTA, INFLAMMATION OF THE. See ARTERITIS.]

APHONIA (from *a* privativum, and *φωνή*, *vox*) is the term used by nosologists to designate that privation or suppression of voice, more or less complete, which occasionally takes place independently of coma or syncope. Dr. Cullen has arranged it in the class *Locales*, and in the order *Dyscinecіæ*, (or impeded and depraved motions, from a fault of the organs;) and has enumerated three species; viz:

1. *Aphonia* gutturalis, from tumefaction of the fauces and glottis:
2. *Aphonia* trachealis, from tumours of neighbouring parts compressing the trachea:
3. *Aphonia* atonica, from mechanical division, or paralysis, of the nerves distributed to the tongue and larynx.

In all these species the loss of voice is only symptomatic; and purely owing to the preternatural condition of the vocal organs. Indeed it is very doubtful whether aphonia is ever an idiopathic affection. In many cases of severe catarrh it is an attendant symptom, and depends upon the lining membrane of the larynx being slightly inflamed and thickened; in the same manner as the Schneiderian membrane of the nose is thickened when we are incommoded by the sensation familiarly called "stuffing in the head."

Again, in many instances aphonia *precedes* or *succeeds* apoplexy; but in such cases it is indicative of plethora, or pressure, within the cranium, and is always to be regarded as a formidable symptom, not from the mere inconvenience of the loss of voice, which is only a subordinate matter, but from the proof it affords that the internal cause, whatever it be, that interrupts the nervous influence, is situated about the base of the brain, and probably in the medulla oblongata, the part from which the nerves of the tongue originate. The medulla oblongata, where the crura of the cerebrum and cerebellum effect a junction with the spinal chord, seems to be the great centre of nervous union and sensorial power. Hence it has been accounted by pathologists the part of the nervous system most indispensable to life. Accordingly, in those cases of apoplexy where the speech is much or permanently affected, our prognosis, for the reasons aforesaid, ought to be always unfavourable. Discussions of this kind, however, more properly belong to the head of apoplexy.

We have sometimes met with aphonia depending upon atony, or relaxation of the vocal chords, in consequence of long-continued over-exertion of the voice in speaking, shouting, singing, or the like.

It is also now and then caused by ulceration of the lining membrane of the larnyx and its cartilages; a disease that gives rise to rapid emaciation, hectic fever, profuse expectoration of frothy mucus, and the other frightful symptoms known to modern practitioners under the name of *phthisis laryngea*. A fatal case of this sort, most distressing in all its details, lately came under our observation, where the ulceration of the cartilages of the larynx occurred as the *sequela* of syphilis.

For the most part, however, aphonia, where it occurs without any palpable disorder, or structural lesion, of the organs of speech, is a modification of hysteria; that Protean malady which assumes such various shapes and hues, and gives rise to such irregular, anomalous, and perplexing symptoms; resisting for months, or even years, the most assiduous and skilful efforts of the practitioner! In cases of this class, the loss of voice is owing to irregular distribution of the nervous influence. This again is caused by general irritability, or susceptibility, of the whole nervous system; or, in other words, by "the hysterical temperament." We shall seek in vain to restore the voice until we have removed that hysterical diathesis on which the loss of it depends.

Cure.—When the disease has not arisen from a cause which contra-indicated emetics, we have generally begun with one; and the following is what we have commonly employed, repeating it at intervals of three or four days, and adding to it, where the patient was robust, from gr. ss. to gr. i. of tartarised antimony:

℞ Vini Ipecacuanhæ f.ʒix.
Oxymellis Scillæ f.ʒiii. M.

The success that has attended its exhibition has been most conspicuous.

Where the disease has appeared symptomatic of catarrh, we have followed up the emetic by saline, demulcent, and expectorant medicines. Leeches, but more especially blisters, to the fore part of the throat, have had an excellent effect.

Where aphonia seems premonitory of apoplexy, the most prompt and effectual depletion by blood-letting, cupping, and purgatives, must be resorted to. Where, on the other hand, it is the consequence of apoplexy, we have chiefly relied on cupping inter scapulas, leeches to the temples, a blister to the head, and, above all, a seton in the nape of the neck.

When aphonia is symptomatic of hysteria (as it so often is), the constitutional treatment adapted to the latter must be had recourse to. We would advise the following formulæ, which we have proved by experience to be well adapted to this and many other varieties of hysterical disorder:

℞ Ferri Subcarbonatis ℈i. ad ʒss.
Valerianæ Pulveris gr. x. M. fiat pulvis ter die sumendus. Or the following pills and mixture may be prescribed:

℞ Pilulæ Galbani Comp.
Pyrethri pulveris, *āā* ʒi.
Olei Anisi guttas vi. M. tere simul optime, et divide in pilulas xxiv. quarum sumat ii. vel iii. omni nocte.

Necnon, ℞ Sulphatis Ferri g. ii.
Acidi Sulphuric. Dil. M. x.
Solve, et adde
Infusi Gentianæ Comp. f.ʒix.
Aquæ Cinnamomi f.ʒiii.
Sulphatis Magnesiæ. ʒi. M. fiat haustus bis quotidie sumendus.

With the above plan, the shower-bath every morning, at first tepid and then cold, (with or without the addition of salt to the water,) may be conjoined, and should be persevered in for several weeks.

It is not unworthy of remark that, in one case of this disease, which had existed long, and resisted a great variety of remedies, we were fortunate enough to effect a cure by half-drachm doses of *balsamum copaibæ*, given three times a day, rubbed up with mucilage of gum arabic and peppermint or cinnamon water.

A. Robertson.

APHTHÆ, (from the Greek ἅπτω, *accendo*, to *inflame*,) is the term employed to denote those numerous white specks, or curd-like vesicles, that not unfrequently appear on the tongue and palate, and gradually diffuse themselves all over the inside of the mouth and fauces. They ought to be considered inflammatory exudations rather than ulcers; for they are not surrounded by any redness; and, when they alternately fall off and re-appear in successive crops, (as they are apt to do,) we find the cuticle abraded underneath, and the parts excessively tender and smarting, but the *cutis vera* unbroken.

Three varieties are enumerated by Dr. Mason Good and other modern writers; viz. 1. aphtha *infantum*; 2. aphtha *maligna*; and, 3. aphtha *chronica*.

Dr. Cullen has placed this disease in the class *Pyrexiæ*, and order *Exanthemata*; but his collocation and definition apply more particularly to the aphthæ infantum, or *milk-thrush*; which is the only variety that can be really or generally considered idiopathic. The others are purely symptomatic, and are chiefly of importance from their indicating a reduced state of the vis vitæ, and an impoverished condition of the blood.

We have witnessed the appearance of the symptomatic varieties in a great many acute diseases. In cases of enteritis; in bilious, remittent, typhoid, and petechial fevers; in hectic fever, from confirmed pulmonary disease, or from the suppuration of psoas abscess in that irritable condition of the alimentary canal denoted by fever, vomiting and purging of bilious or other acrid matters; in the *febris lenta* attending diabetes, atrophy, &c.; in the fever accompanying sloughing wounds or scorbutic ulcers; in short, in various states of great constitutional irritation and prostration we have found aphthæ to supervene. They are always to be looked upon as a most unfavourable symptom; not from any mischief inherent in themselves, or caused by them, but from their indicating general exhaustion and prostration of the system.

We have known, however, very many acute cases terminate favourably, notwithstanding the occurrence of aphthæ during their progress; and, indeed, so long as the aphthous specks retain their purely-white colour, little danger need be apprehended. But when the early crops fall off and are succeeded by others, at first yellow in their hue, and gradually degenerating into *brown* or *black*, they may be looked upon as almost infallible tokens of a fatal issue to the concomitant disease, whatever that disease may be.

In such disastrous circumstances the aphthæ pervade the whole alimentary canal. Indeed some authors of reputation contend, from the cardialgia, singultus, acid eructations, and gripings that usually precede or accompany them, that they always originate in the stomach, even before they manifest themselves in the mouth and fauces. Be this as *it* may, it is unquestionable that in all cases where aphthæ show themselves, they are preceded by evident acrimony in the stomach and duodenum.

The treatment, under such a state of things, ought obviously to be directed rather to the concomitant disease than to the aphthous condition of the mouth and throat. But as the latter is often productive of great distress in swallowing either nourishment or medicine, gargles and other topical detergents must not be neglected. We have experienced beneficial effects, in some severe cases, from pencilling the inside of the mouth with a solution of argentum nitratum, in the proportion of ʒss, or even ℈ii, to an ounce of water. Gargles also of sage-tea, or of simple infusum rosæ, are often useful. One drachm of alum to a *pint* of infusion of red rose-leaves frequently has a good effect in cleansing the mouth. But, upon the whole, the most soothing application we have yet found is the following:—

℞ Sodæ boratis ʒi. ad ʒii.
Aquæ f.℥vii.
Mellis rosæ f.ʒvii.
Tinct. Opii f.ʒi. M. fiat gargarisma.

Frequent sips of this are to be taken, and held in the mouth for four or five minutes at a time, and afterwards discharged.

The aphtha *infantum* usually attacks those children that are brought up by hand, rather than such as live entirely on the breast. In such cases the exciting cause is the food not being properly digested, but becoming acid and acrimonious in the first passages.

The first step in the treatment is well to evacuate the primæ viæ by castor-oil, magnesia and rhubarb, or manna dissolved in warm milk. Our next measures must be to obtund acrimony, and excite perspiration. These purposes will be best accomplished by the warm bath, particularly where there is much febrile heat, or where the child is tetchy and restless; and also by f.℥ss of mistura cretæ with M. v. of vinum ipecacuanhæ, given every four hours. We would recommend the following formulæ:

℞ Cretæ preparatæ ℈ii.
Mucilaginis acaciæ f.℥ss. Tere simul, et adde aquæ f.℥iss.
Liquor. ammon. acetat. f.ʒvi.
Spir. æther. nitric. f.ʒiss.
Vini antimonii f.ʒss. M.

The dose a table-spoonful every four hours.

With infants who cannot employ a gargle, a linctus, consisting of ʒi of borax (sub-borate of soda), rubbed up in one ounce of mel rosæ, and applied frequently to the mouth and fauces by means of a feather, or a camel-hair pencil, is often a useful succedaneum.

Where the aphthæ put on a dark or sloughing appearance, the sulphate of quinine dissolved in the infusion of roses, or the decoction of bark acidulated with muriatic or dilute sulphuric acid, must be resorted to in doses adapted to the age and other circumstances of the patient. Port-wine or brandy must also be exhibited. Gargles and the inhalation of the vapour of warm water and vinegar, must likewise be employed. Of all topical applications, however, the most powerfully antiseptic we are acquainted with is the following:

℞ Liquoris sodæ chlorinatæ, tincturæ myrrhæ *āā* f.℥ss. Aquæ f.℥vi. Aquæ rosæ f.℥i. M. fiat gargarisma sæpissimè adhibendum.

A. ROBERTSON.

[There appears to be a marked difference between the pultaceous inflammation of the mouth, that constitutes *Aphthæ Infantum*, and the follicular inflammation that constitutes *Aphthæ Adultorum*. The latter — *aphthous stomatitis* — is seated chiefly in the follicles of the mucous membrane of the mouth; hence the name FOLLICULAR STOMATITIS, given to it by some. When the membrane is inspected at an early period of the disease, it presents the appearance of simple stomatitis; and afterwards, small transparent, greyish or whitish vesicles are perceptible, and at the base of each vesicle there is a raised ring, which is resisting, and of a white colour. Subsequently the vesicle gives way at the top, and allows the fluid to escape from it; after which it becomes transformed into an ulcer, which spreads, and is bounded by a red circle,— the raised border that occupied or surrounded the base of the vesicle gradually disappearing. Cicatrization succeeds,— at times rapidly, but at others gradually,— whilst at others, again, it is exceedingly tardy, and the ulceration is very apt to recur after it has once healed. Cases very difficult of management are occasionally seen in nursing-women; and, what is singular, they would seem to occur more frequently in certain localities than in others, owing to causes that have not yet been appreciated. The *stomatitis of nurses* is not, however, peculiar to this country, as has been imagined by some.

The treatment of the aphthæ of the adult must be regulated greatly by the concomitant condition. In the first instance, mucilaginous, and, afterwards, gently astringent collutories may be prescribed; and, where the ulcerations are not numerous, they may be treated with solid nitrate of silver, sulphate of copper, or tincture of iodine. If inflammatory symptoms accompany them, the constitutional phenomena must be met by appropriate remedies. Often the affection is manifestly adynamic, and requires the use of tonics, as the cold infusion of cinchona; and very obstinate cases require the thorough revulsion which travelling air and exercise are capable of effecting. With the same view, the various eutrophics may be needed which are prescribed in other cases of faulty nutritive action of the dermoid tissues. (*Practice of Medicine*, 2d edit. p. 32: Philad. 1844.)

ROBLEY DUNGLISON.]

APOPLEXY CEREBRAL.—*Apoplexy* (from the Greek word ἀποπλήσσω, to strike) has been defined, loss of sensation, voluntary motion, and intellect or thought; respiration, and the action of the heart and general vascular system, being continued. The disease has been so termed from the suddenness and violence of the attack in many instances; and, for the same reason, the patient is said to be *attonitus* (thunder-struck), or *sideratus* (planet-struck); as if the disease were of unearthly origin.

It is liable to be confounded with *syncope* or fainting, and with natural sleep; from both of which, for the purposes of practice, it requires to be distinguished. In syncope, respiration is suspended, the pulse is not to be felt at the wrist, the features shrink, and the surface of the body turns pale and cold. In apoplexy, the reverse of all these takes place. It is less easy to discriminate between apoplexy and natural sleep: the distinction can only be made, indeed, by our being able to rouse the person from sleep, however profound, by a certain degree of irritation: this cannot be done, or but very imperfectly, in apoplexy. The suddenness and violence with which apoplexy often makes its attack; the total loss of consciousness, of feeling, and of voluntary movement that attends it; and the not unfrequently fatal termination of the disease, are circumstances well calculated to attract, as they have actually attracted, the attention of physicians from a very early period. We find it accordingly described by the Greek and Roman writers, and their successors of the Arabian school, with a minuteness and accuracy that have hardly been exceeded in modern times. Little, however, is to be found regarding its intrinsic nature till within a comparatively late period; and even at present the pathology of the disease is far from being satisfactorily settled, if we may judge from the various and contradictory opinions that have been entertained on the subject.

General description.—There is great diversity in the mode of attack of apoplexy, as well as in the greater or less severity of its symptoms. Sometimes the attack is nearly instantaneous and complete; the patient, previously in apparent health, falling down insensible, with an immediate abolition of all the sensorial functions. On other occasions the approach of the stroke is felt by the patient: he puts his hand to his head, or makes an alarming exclamation of something unusual felt in the head; and then falls down insensible. In most cases, (and probably it would be found so in all, if sufficient attention were paid,) the attack is preceded, for a longer or shorter period, by pain in the head, or by more or less of disorder in the sensorial functions; such as tinnitus aurium, imperfect vision, numbness or a sense of pricking in the extremities, giddiness, imperfect articulation, loss of memory, drowsiness, or nightmare. The degree in which the sensorial functions are impaired in apoplexy is also various. In the more severe cases, sensation, voluntary motion, and intellect, are all entirely abolished. In slighter affections, the patient retains some degree of consciousness, is sensible to impressions, and capable, to a certain extent, of voluntary movement. The pupils of the eyes are variously affected at different times. Although, in many cases, they are observed to be largely and equally dilated, and insensible to the impression of light, there are still more in which they are in a contracted state, though often unequally in respect of each other. Sometimes they contract and dilate alternately with great quickness, without being influenced by the stimulus of light. Sometimes one side of the body lies motionless, without manifesting the least degree of feeling, even when strongly irritated; while convulsive movements, with perhaps some degree of feeling, are perceived on the opposite side. We are then enabled to predict that, in case of recovery from the apoplectic state, hemiplegia will be left behind. The disease consisting essentially, as will be shown hereafter, in a suspension, more or less perfect, of the sensorial or proper functions of the encephalon, other functions are not necessarily deranged; nor when they are so, is it in any uniform way. Respiration, in violent cases of apoplexy, is commonly slow and laborious, the patient snoring loudly as in deep sleep. At other times the breathing is natural. The general circulation of the blood, as indicated by the pulse at the wrist, is equally various in apoplexy. Sometimes the pulse is slow, full, and bounding; with flushing and fullness of the face, and heat of the extremities: at other times the pulse is small and weak, or perhaps irregular; while the face is pale, the features are shrunk, and the extremities cold. In extreme cases, such as are likely to prove almost immediately fatal, the pulse from the beginning is imperceptible, or nearly so; the heart appearing to be paralyzed, as well as the voluntary muscles. In such cases death quickly ensues. The alimentary canal is also variously affected in apoplexy. In some cases, the power of swallowing is lost or impaired; and in such it is hazardous to administer any thing by the mouth, as being likely to induce suffocation, or at least to excite violent cough, which is not without danger to the patient. In numerous instances apoplexy is ushered in by vomiting; the disease then is often referred to a disordered state of the stomach, as the primary cause; but generally without reason, the disorder of stomach being mostly secondary, and dependent upon the brain. The mistake is important, as leading to the employment of emetics, the use of which is not unattended with danger. The bowels are commonly torpid in apoplectic cases. Sometimes, however, the urine and fæces escape involuntarily. This marks a state of disease which generally proves fatal. Profuse sweating is also among the most unfavourable signs.

Apoplexy may last but for a short time, as a few minutes, and then entirely disappear; or it may prove fatal immediately, or after the lapse of a few hours ; it may even continue for several days, and then prove fatal. In a considerable number of instances it ends in hemiplegia, consciousness returning, while voluntary motion, and sometimes sensation, are lost. Palsy has thus been called a minor degree of apoplexy. Hemiplegia may take place in very different degrees : the entire half of the body sometimes suffers, the medial line being marked with great accuracy ; so that one half the tongue only, with its muscles, is paralyzed. Or the affection may be confined to the face, or to a single limb. The approach of apoplexy is sometimes denoted by merely a loss of feeling in one or more of the fingers.

In some cases of hemiplegia, the sensibility of the part remains, or is even morbidly increased ; while the voluntary muscles are alone paralyzed. In higher degrees of the disease, both the blood-vessels and the absorbents appear to partake of the paralysis, if we may judge from the weaker state of the pulse, as compared with that on the sound side, and also from the œdematous state of the limb ; which seems to show deficient absorption.

In all cases of apoplexy there is a disposition to a recurrence of the disease ; the number of fits and the period of recurrence being uncertain. In most cases the patient is sooner or later destroyed. Many persons survive a considerable number of slight attacks, but the more severe commonly prove fatal on the second or third occasion ; thus verifying, in some degree, the popular remark, that the third fit of apoplexy always kills the patient.

Apoplexy may take place at any age, but is comparatively rare at the early periods of life ; and when it does occur in the young, it usually comes on slowly, and not by a sudden stroke, as at a more advanced age. A great proportion of old people are cut off by apoplexy. The form of body appears to give a predisposition to the disease, as a large head, short neck, and corpulency of habit. Luxurious diet, excess in drinking, prolonged study, and intense thinking, are all circumstances giving predisposition to the disease. Apoplexy is of more frequent occurrence in men than in women ; probably from the former being more addicted to excesses, both as regards body and mind.

Morbid appearances.—It is reasonable to expect that the intrinsic nature of apoplexy might be determined by a careful examination, after death, of the organ principally affected. This, however, as will be presently seen, is true to a certain extent only ; for there are numerous instances on record of apoplexy proving fatal, where no change in the structure or condition of the brain could be detected, that was at all adequate to explain the symptoms of the disease, or to account for the death of the patient. And even where manifest changes have been observed, they have been so various, and of so common a description, as to afford no complete or satisfactory elucidation of the subject.

Many of the morbid appearances mentioned by writers as having been observed in the brain of persons who have died of apoplexy, are by no means to be considered as the immediate cause of the apoplectic state, since similar appearances are found in other kinds of cerebral disease, while they are not invariably met with in apoplexy itself. The morbid appearances to which we allude are, malformations of the cranium, ossification of the membranes or blood-vessels, adhesion of the membranes, false membranes, alteration in the texture of the brain, *i. e.* unusual hardness or softness, tumours, hydatids, concretions of various kinds, &c. On the other hand, cases of apoplexy have been recorded in which the apoplectic seizure has proved fatal without leaving any discoverable lesion in the brain, though the symptoms were well marked before death. To these cases, which are certainly uncommon, Dr. Abercrombie has proposed to apply the term *simple* apoplexy.

[It is also termed *nervous apoplexy.* The attack is almost always sudden, and immediately succeeding some powerful mental emotion. Should the symptoms of apoplexy have occurred many times; have continued for a short period only, and left behind them no evidence of modified condition of the encephalic neurine, it has been inferred that the apoplexy is of this variety. This inference might, however, be very erroneous, inasmuch as all the functional phenomena of apoplexy may be developed under a hyperæmic condition of the vessels of the encephalon, which may soon pass away.]

The morbid changes in the brain generally observed after death, which really appear to give rise to the apoplectic state, are the following :—

1. *Extravasation of blood.*—This is generally a fatal termination of apoplexy, and may be suspected, if not positively predicted, when the attack occurs suddenly and unexpectedly, the patient becoming at once motionless and insensible, to which condition convulsions sometimes succeed. In other instances the individual does not become instantly insensible, but complains only of uneasiness or fixed pain in the head, often confined to one side. He may remain sensible for some time after the attack of head-ach ; more or less oppression, however, succeeds, till perfect coma is established, from which recovery never takes place. The blood in those cases is found extravasated most commonly in the substance of the brain in cavities of different sizes ; sometimes there is a communication between the cavity thus formed and the ventricles, or the blood finding its way through a lacerated opening to the surface, becomes extravasated under the arachnoid membrane. When the blood has been effused in one hemisphere of the brain, palsy of the opposite side has been observed before death. The appearance of the extravasated blood varies according to the duration of the disease. When the apoplexy has proved suddenly fatal, the blood is dark-coloured, almost fluid, or in soft semi-liquid masses. If the patient survives for a longer period, the coagulum acquires a greater degree of consistency, and is of a pale red and sometimes dark yellow colour. The substance of the brain surrounding these apoplectic cysts becomes altered ; it generally appears injected, and acquires a greater degree of softness ; this softened state does not extend deep, but becomes gradually less and less perceptible, till it is impossible to discover any difference between the sound and diseased portion of the brain. The quantity of blood which is thus extravasated is

very various: in some cases it does not exceed a few drops—often, however, two, four, or six ounces have been found in these cysts.

Extravasation of blood, nevertheless, is not always fatal, as appears from the changes observed in the brain of persons who have survived the apoplectic attack, but remained paralytic, with more or less disturbance in the sensorial powers. In such cases the blood which has become effused is partially or in some instances entirely absorbed, and the parietes of the cyst undergo a reparative process—a partial cicatrization; they approximate and become slightly connected by soft intersecting bands, so as to form little cavities, which sometimes contain a fluid of various quality and appearance. The number of these old apoplectic cysts corresponds with the sanguineous effusions which have at different times taken place, and therefore several have been found in the same brain. In some rare instances these apoplectic cysts have been found completely cicatrized, which shows how much is often effected by the reparative powers of the system itself. With regard to the source of the hemorrhagic effusion, in apoplexy, it appears from the researches of M. Serres that the blood may in some cases proceed from the minute vessels of the brain without rupture, constituting that form of the disease to which the French writers have applied the term meningeal apoplexy: in these cases the blood escapes from the vessels of the arachnoid into the subjacent delicate cellular tissue, or into the cavity of the ventricles; and the substance of the brain is sound. When blood is found in the ventricles, it may proceed from this source, or from the vessels of the choroid plexus, or from a communication with an apoplectic cyst in the substance of the brain.

The hemorrhage, however, most usually takes place from rupture of the blood-vessels:* in elderly persons the arteries of the brain often become diseased from ossification; hence, when the blood is impelled with more than ordinary force, they are liable to give way, especially at those periods of life, when the solids in general lose their firmness.—"Omnes rami carotidis," says Haller, "qui cranio continentur, tenui, solidâ, fragili magis, quam reliquæ arteriæ, substantiâ sunt."—*Halleri prim. lin.* § 337. Sometimes the blood issues from a congeries of these small arteries, occasionally from an artery of considerable size. Thus M. Serres traced in one instance the source of the hemorrhage to rupture of the communicating artery of Willis. In another individual it took place from aneurismal disease and rupture of the basilar artery. In one case, reported by M. Moulin, of apoplexy which proved suddenly fatal, six ounces of dark-coloured blood were found in the centre of the cerebellum, which had arisen from rupture of the trunk of the inferior cerebellar arteries. It would appear that, in all these cases, the morbid condition of the arteries constitutes the principal and primary lesion. In the sixth volume of the Edinburgh Medical Essays, a case is given by Dr. Douglas, in which the left lateral sinus was ruptured; and a very uncommon case (quoted by Abercrombie) is recorded in the Medical and Surgical Register of the Hospital of New York, of a man who was suddenly seized with hemiplegia of the right side, and died five days afterwards. On examination of the brain, blood was found between the dura mater and bone, which was traced to erosion of a vessel from caries of the inner surface of the parietal bone of the left side, not larger than a sixpence.

The most frequent seat of extravasations of blood in apoplexy, according to Morgagni, is the *corpus striatum.* This opinion has been found substantially correct by modern writers. Of twenty-eight cases examined by Rochoux, in twenty-four the extravasation was found in the *corpus striatum.*

[Of 386 cases, recorded by M. Andral, the extravasation was seated in the part of the cerebral hemispheres, situate on a level with the corpora striata and the optic thalami, and at the same time in both those bodies, in............ 202 cases

In the corpora striata, in..........	61	"
In the optic thalami, in...........	35	"
In the portion of the hemispheres above the centrum ovale of Vieussens, in	27	"
In the lateral lobes of the cerebellum, in	16	"
Anterior to the corpora striata, in...	10	"
In the mesocephalon, in	9	"
In the spinal marrow, in..........	8	"
Behind the optic thalami, posterior lobes, in	7	"
In the median lobe of the cerebellum, in	5	"
In the peduncles of the brain, in ...	3	"
In one peduncle of the cerebellum, in	1	"
In the corpora olivaria, in	1	"
In the pituitary gland, in	1	"
In the central white parts, in	0	"
	386]	

Morgagni thought that the blood was more frequently effused on the right than on the left side of the brain. This, however, does not accord with the experience of Rochoux, who found, that of forty-one cases, examined after death, in eighteen the extravasation was in the left hemisphere; in seventeen on the right side, and in six it had taken place in both hemispheres.

2. *Serous effusion.*—When serous fluid is accumulated largely in the brain, so as to occasion apoplexy by pressure, the chief seat of the fluid is the different ventricles; though more or less is generally found every where between the membranes, often passing down the spinal column. Apoplexy may be suspected to depend upon this this cause, when the symptoms of oppressed brain come on slowly, and in an imperfect degree, without any thing like a sudden stroke or fit. In many of these cases, however, of what is termed *serous* apoplexy, a sudden and more violent attack succeeds, so as to prove quickly fatal; and in such cases blood as well as serum is often found effused in the brain after death. Hence it is obvious that no absolute line of distinction can be drawn between *serous* and *sanguineous* apoplexy;

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* [This is not in accordance with the investigations of pathologists. On the contrary, the appearances on dissection favour the view that the hemorrhage generally occurs from transudation through the parietes of the vessels, which in many cases are softened simultaneously with or subsequent to the ramollissement of the encephalic neurine.]

nor are they to be distinguished with certainty by symptoms during life.

Serous apoplexy has been too generally supposed to be the only form of the disease to which persons of a spare infirm habit, with pale countenance and feeble pulse, are liable. This, however, is a very erroneous idea. In many cases which have presented, during life, all the symptoms and characters which have been usually regarded as pathognomonic of serous apoplexy, extravasation of blood has been discovered on dissection. Again, in fatal cases of apoplexy, in which serous effusion has constituted the only morbid appearance discovered, all the symptoms of sanguineous apoplexy have been observed during life, so that the only legitimate conclusion is, that the effusion is the effect of the previous vascular disturbance in the brain, and analogous to the dropsical effusion which often occurs after inflammation of serous membranes. It is equally apparent that the effusion is not the cause of the apoplectic symptoms,—these are produced by the morbid condition of the brain on which the effusion depends.

The *cerebellum* being seldom affected in apoplexy, (the disease being for the most part confined to the cerebrum,) accounts sufficiently for the continuance of the action of the heart, and of respiration during the fit; these functions being more immediately dependent upon this part of the nervous system. [This view is not sustained by the observations of modern physiologists. The action of the heart is certainly not more immediately dependent upon the cerebellum; whilst the medulla oblongata would seem to be the nervous centre of respiration.] For the same reason, other functions dependent upon the general circulation often go on unimpaired; as secretions of various kinds, and the evolution of animal heat.

In many cases an unusual degree of turgescence of the veins upon the surface of the brain has been observed. This appearance has furnished the grounds of the doctrine of *venous congestion*, of which so much use has been made of late, in attempts to explain the nature of apoplexy. But there is a fallacy here, which renders such an explanation very unsatisfactory, as will hereafter be shown.

Causes of Apoplexy.—These have been divided into *external* or obvious, and *internal*, or such as can only be discovered by dissection after death. It is, however, necessary to observe that many cases are recorded of apoplexy taking place without any apparent external cause, while no *internal* cause, sufficient to account for the production of the disease, could be detected after death.

The obvious *external* causes of apoplexy are the following:

1. Causes acting *mechanically*, by making pressure on the brain: such are, fracture of the skull with depression of a portion of bone; or blood extravasated immediately beneath the fractured bone, without depression. The reality of this cause is shown by the effect of direct pressure made upon the surface of the brain by the point of the finger, in cases where a portion of the skull has been removed by the trepan; or on the fontanelle or opening between the cranial bones in the head of infants. Some nations are said to destroy their supernumerary offspring in this manner.

2. Causes tending to increase the arterial action of the brain; either by direct application to the head itself, or, indirectly, through the medium of other organs. Of the former kind are, insolation, or exposure of the naked head to the mid-day sun; and erysipelas affecting the scalp. The indirect causes of vascular excitement of the brain are various:—external heat applied extensively to the skin, either through the medium of the surrounding air, or by means of the hot bath; breathing a heated atmosphere, especially in crowded rooms, the effect being probably increased by breathing contaminated air; the inhalation of carbonic acid gas, and probably of other mephitic airs; violent exercise; certain emotions of mind, as anger, terror, or joy; indulgence in the pleasures of the table, intoxicating drinks, opium, and other drugs of the narcotic tribe. Violent concussion of the brain, occasioned by blows or falls, induces a suspension of the sensorial functions, or an apoplectic state. This suspension of functions may be momentary, or it may be more durable; even life itself may be instantly extinguished in this way, according to the violence of the shock sustained.

3. Causes which operate by impeding the return of blood from the brain; as stooping; the application of a tight ligature round the neck, so as to compress the internal jugular veins; tumours of any kind so situated in the neck or chest, as to interrupt the return of blood from the brain to the heart; diseases of the heart or lungs impeding the transmission of the blood through the pulmonary vessels; or a voluntary suspension of breathing after a full inspiration; as in blowing wind-instruments, or in making great muscular efforts of any kind.

The *internal* causes of apoplexy, or those that are only discoverable after death, are—extravasation of blood in the substance of the brain or in the ventricles, or serous accumulations in any of the cavities, or between its membranes; tumours of any kind, within the skull, of magnitude sufficient to press considerably upon the brain. Among the occasional causes of apoplexy also may be mentioned some forms of fever, and all the other forms of cerebral inflammation. Epilepsy and hysteria, likewise, often terminate their paroxysms by stupor, or an apoplectic state; which in general disappears after a few hours, though it sometimes ends fatally. Extreme cold, long continued, induces a state resembling apoplexy, as far as regards the suspension of the primary functions of the brain.

How these different causes, at once so numerous and apparently dissimilar in nature, operate so as to produce the apoplectic state, is an inquiry of some difficulty. It is, however, one of much practical importance, as the rational, and probably the most successful treatment of the disease will depend greatly upon a knowledge of the particular cause, and its mode of acting. These will be more fully considered hereafter.

Theory of Apoplexy.—There are two points here to be determined, or at least to be inquired into, namely, the primary and essential seat of the disease, and the intrinsic nature of the affection.

With respect to the former, there is little difficulty. When we consider attentively the essential characters of apoplexy,—that they all refer themselves to the brain, and consist in a suspension or interruption of the sensorial or proper functions of this organ, it would seem impossible to refer them to any other source. Some, however, have looked to the stomach as the primary seat of apoplexy, at least in those cases where the attack supervenes upon a full meal, or is ushered in by vomiting. The notion that a distended state of stomach acts by compressing the descending aorta, and thereby determining a larger flow of blood to the brain, is too mechanical to be probable. Were this a satisfactory explanation, it would be an easy matter to produce apoplexy at any time, by even moderate pressure at the pit of the stomach. An easier explanation may be given. The stimulus of a hearty meal, aided, as it commonly is, by strong drink and mental excitement, has been sometimes followed by, or it may be said, has given rise to, a fit of apoplexy; but it is by exciting the vascular action of the brain that such a cause operates. The brain is still the part from the affection of which the apoplectic state arises; the stomach is merely the medium through which the brain is impressed. As to to the fact of many cases being ushered in by vomiting, thus affording, it was imagined, a proof that the stomach is primarily concerned, it is rather taking the effect for the cause. The same observation applies to the lungs. When the lungs are so diseased as to be unable to transmit the blood through them with sufficient freedom, the vital fluid will be deficient in those properties which it derives from the atmosphere in respiration, and by which it is fitted to maintain the living actions. In this state, it may, no doubt, contribute to the production of that general torpor of system which is so evident in such cases. But much more is attributable to the mechanical impediment afforded to the return of blood from the brain, by which the cerebral circulation is interrupted, and the functions of the organ thereby suspended or annihilated: apoplexy, therefore, is always and essentially a brain affection.

The determination of the second point of the theory, viz., the actual condition of the organ affected—the brain—in other words, the *proximate* or immediate cause of the symptoms, is a matter of greater difficulty, and about which a variety of opinions have been entertained; few of which, however, are deserving of serious notice. Among these may be mentioned the notion that the symptoms are caused by a morbid state of the animal spirits,—by fermentation or ebullition of the blood,—by a relaxation of the nerves,—by spasm of the meninges or membranes covering the brain,—or by spasm of the nerves and vessels of the brain,—(hence the term *nervous* apoplexy, still employed by some to designate those instances of the disease in which no morbid change is discoverable after death.) It is hardly necessary to observe that these notions are purely hypothetical, and rest upon no sort of foundation; and much more cannot be said, it may be feared, in favour of the opinion of Dr. Cullen, that certain of the causes of apoplexy operate by inducing an immobility of the nervous fluid. Other immediate causes of the apoplectic state have been assigned; as compression of the cerebral substance, and venous congestion; both of which, however, are liable to insuperable objections, as will appear upon a fuller investigation hereafter. With much greater probability may the symptoms of apoplexy be referred to impeded or interrupted circulation in the brain, a state which most, if not all, of the known and obvious causes of the disease have a manifest tendency to produce, and which seems fully adequate to the production of the effect, namely, a suspension of the sensorial functions. When it is added that the treatment of the disease will very materially turn upon the admission or disproval of this opinion, it will be readily allowed to be deserving of minute investigation.

The nature of apoplexy in general, however, cannot be understood, nor its most essential symptoms explained, nor the operation of its causes made intelligible, without adverting to certain physical peculiarities, by which the brain is distinguished from other organs. These peculiarities are not now brought forward for the first time. They were long ago demonstrated by the eminent professor at Edinburgh, the late Dr. Monro, and have been recently confirmed by a variety of well-conducted experiments instituted on the subject by Kellie, Abercrombie, and others, who have drawn a number of important conclusions from the facts so established. These facts, as well as the inferences deducible from them, have been strangely neglected, and indeed have been scarcely at all referred to either theoretically or practically, by recent writers on diseases of the brain; although it is quite impossible, without having recourse to them, to explain or even to comprehend a great number of the phenomena that attend such affections.

The physical conditions, then, by which the brain is distinguished from other organs, are those which follow:

1st. The brain is enclosed in an unyielding case of bone, the cranium or skull, the contents of which are by this construction excluded from the influence of atmospheric pressure.

2dly. The cavity of the skull is always accurately filled by its contents, namely, the encephalon or general mass of brain, including the membranes, and vessels, and the blood contained within them. So long as the skull is perfect, there can be no rising and falling of the brain, so as in the latter case to leave a vacuity between the skull and the surface of the brain, these parts being always in actual and close contact.

3dly. The contents of the skull solid as well as fluid, if not absolutely incompressible, at least are so by any force that can by possibility be applied to them during life; and there is no air, or other elastic fluid, to be found within the cavity.

This incompressibility of the cerebral substance is easily demonstrated by experiment. It is a property by no means belonging exclusively to the brain, more than to the whole of the animal solids. This is the less to be wondered at, when it is recollected how large the proportion of water is which enters into the composition of these, and that water, as well as other fluids, is so nearly incapable of compression as to require a vast force to render it at all perceptible. But although the substance of the brain, in common with other animal solids, be incompressible, its blood-vessels will readily yield to pressure, so as to be emptied of their contents; a necessary consequence of which is, a stoppage of the circulation in the part so affected. The pressure may be made to take place on any part of the brain, even the most remote from the principal vessels; yet nevertheless the pressure, by operating through an incompressible substance, may influence vessels the most distant, so as thereby to impede, if not wholly interrupt, the cerebral circulation.

The circumstances above stated with respect to the brain, lead to very important deductions, both theoretical and practical. It follows, *ex necessitate rei*, that no material variation can take place, within a short period, in regard to the absolute quantity of blood in the brain. No additional quantity can be admitted into the blood-vessels situated there, the cavity of the skull being already completely filled by its contents. A plethoric state of over-fulness of the cerebral vessels altogether, though often talked of, can have no real existence; nor on the other hand can the quantity of blood within the vessels of the brain be diminished, any more than can wine or other fluid be drawn from a cask without furnishing an equivalent for the portion abstracted from it, by the supply of an equal bulk of air, which in the case of the brain can of course find no entrance. No abstraction of blood therefore, whether it be from the arm or other part of the general system, or from the jugular veins, (and still less from the temporal arteries,) can have any effect on the blood-vessels of the brain, so as to lessen the absolute quantity of blood contained within them.

From the experiments of Dr. Kellie, it was found that in animals bled to death the brain still contained the usual quantity of blood; and in some cases the superficial veins were found gorged with blood, and the sinuses full; the rest of the body being at the same time blanched, and drained of its blood. In a few instances, the brain appeared to contain less blood than usual; but then there was found some serous exudation. When the cranium of the animals subjected to these experiments was perforated before they were bled, the brain was as much emptied of its blood as the rest of the body. In two instances of persons that had been hanged, the cellular membrane of the whole head externally was turgid with blood; but nothing peculiar was observed in the state of the vessels of the brain itself. When blood is suddenly or rapidly extravasated anywhere within the skull, the space thus occupied can only be furnished by the compression and consequent emptying of the blood-vessels in other parts of the brain; and in the same degree that this happens, it is evident that the circulation of such parts must be interrupted. But in the formation of tumours within the skull, and during the slow accumulation of serum from inflammation or any other cause, the cerebral substance itself may be absorbed, to an extent corresponding with the bulk of the tumour, or the quantity of serum deposited. The circulation of the brain may then go on uninterruptedly, and thus the apoplectic symptoms be prevented.

But although, under ordinary circumstances, the absolute quantity of blood contained within the vessels of the brain must remain the same, there may be great differences in regard to its distribution, and the force and velocity with which it is moved. Thus, the arteries of the brain altogether may be unusually distended with blood; but in this case the veins will be in the same degree compressed and emptied, and the circulation of the organ proportionally interrupted, with a corresponding interruption of functions.

Again, there may be a partial fulness or distension of vessels in one part of the brain only, but this must be at the expense of the rest of the brain, which will be proportionally deprived of the usual supply of blood. This will be the case in circumscribed cerebral inflammation, as well as in other cases of partial excitement of the organ. The different parts of the brain will then be in different, and perhaps opposite states, in regard to the performance of their functions. The functions of one of the cerebral organs may be excited, while those of another may be imperfectly carried on or depressed. Such an inequality in the state of the cerebral functions is observable in most diseases of the brain; for there are probably few in which the whole organ is simultaneously and equally affected.

In like manner there may be great diversity with respect to the force and velocity of circulation in the brain; the absolute quantity of blood in the vessels remaining still the same. In this way the functions may be more or less excited, or more or less disturbed. These changes in the state of the cerebral circulation are all independent of the heart, the action of which has but little influence over the brain or its functions. It follows, from what has been now stated, that blood-letting, when employed as a remedy in apoplexy or other brain-affections, however useful it may be and undoubtedly is, in many cases, does not effect its purpose by diminishing in any degree the absolute quantity of blood in the brain, but by reducing the velocity and impetus of the circulation there, and which it does by influencing the general system.

We have seen that the changes observed in the brain of apoplectic persons are very dissimilar; and that, in some instances, as has been stated above, no material deviation from the natural state of parts has been found; it is plain, therefore, that such changes, when they do occur, cannot be the proximate cause, the *causa continens*, of the symptoms, but are to be considered, at most, as remote causes; and, with regard to some of them, are to be looked upon rather as mere coincidences than causes.

The opinion that appears to prevail most generally at present, as to the immediate cause of the suspension of functions that constitutes the apoplectic state, is that the remote causes of the disease, such as extravasated blood, and accumulation of serum, produce a compression of the cerebral substance, thereby interrupting its functions. But, besides that some of the remote causes of apoplexy have no apparent tendency to make any direct pressure on the brain, it must not be overlooked that the cerebral substance being in its nature incompressible, cannot, so long as the blood is contained within its vessels, be exposed to greater pressure at one time than another. It must be in some other way, therefore, than by compression of the substance of the brain, that the remote causes act in producing their effect. It cannot be questioned that pressure on the brain of any kind, if carried to a certain extent, is capable of interrupting the functions of the organ so as to induce apoplexy; but there is good reason to believe that the pressure operates upon the blood-vessels, so as to impede mechanically the passage of the blood through them;—in a word, that interrupted circulation in the brain is the proximate or immediate cause of that temporary suspension of the sensorial functions which constitutes the apoplectic state. To establish this opinion, it will be necessary to show ground for believing, first, that these functions are dependent, for their performance, upon the continuance of the cerebral circulation; and, next, that all the remote causes, the operation of which is at all understood, have a manifest tendency to produce such an interrupted state of circulation in the brain. If these points are established, it is plain that a different indication of cure ought to be followed, from that usually pursued.

It can scarcely be doubted, we imagine, that the brain, in common with other organs, depends mainly for the performance of its functions upon the continued circulation of blood through its vessels, and without which those functions must soon cease to be performed. This dependence of the sensorial functions upon the circulation of the brain, is shown, first, in the case of *syncope;* in which the action of the heart ceases altogether, or nearly so, for a time; and, consequently, little or no blood is sent to the brain. In this case, the sensorial functions are suspended, the patient becoming unconscious, insensible to impressions, and without voluntary movement. If, on the other hand, the return of blood from the brain to the heart be obstructed by causes influencing the veins, the same interruption is given to the circulation of the brain, and the same suspension of its functions follows. This is seen, where the head is made the most depending part, as in stooping, in persons who are predisposed to apoplexy: the vessels for a time are incapable of carrying the blood upwards against gravity, and it necessarily therefore stagnates in the vessels of the brain; with the same consequence as before, suspension of the sensorial functions. Were it practicable to tie the internal jugular veins, it can hardly be doubted that the same effects would follow; for a less complete obstruction to the return of blood from the brain, by these veins, produces similar effects; such, for example, as is occasioned by tumours in the neck, or in the course of the superior cava, or by disease of the heart or lungs; all of which give a tendency to apoplexy. There is so far an analogy between the two states of syncope and apoplexy, that in both the circulation of the brain is interrupted, and in both the sensorial functions are suspended. The difference is not as regards the brain itself, but the rest of the body. In the one case, (syncope,) the blood ceases to be sent to the head altogether; but in the other case, (apoplexy,) the blood is stagnant in the brain only; while the heart continues its action, and the general circulation is still carried on, the pulse beats, and the vivid hue of the countenance is preserved.

These two cases, of syncope and apoplexy, would seem to prove sufficiently that unless the circulation of blood through the brain be continued, the organ is incapable of carrying on its functions. But while this is admitted, it is of importance also to know that the brain is much less dependent upon the action of the heart and general vascular system than is commonly supposed. It is upon the action of its own vessels that the brain chiefly depends for the performance of its functions, and the modifications which those functions occasionally undergo, both in health and in disease. We frequently observe the action of the heart and general vascular system greatly increased and disordered, as in acute rheumatism and other active inflammations, where the pulse is full and strong, and the general circulation carried on with the greatest vehemence, and yet the proper functions of the brain are undisturbed. This it is not difficult to understand, when we advert to the contrivances of nature to guard the brain against any violent impulse of the blood, as derived from the heart; by the bony and tortuous canals through which the arteries enter the skull, the anastomoses which take place within, and the minute divisions and ramifications which the arteries subsequently undergo, before they arrive at, and are distributed throughout the cerebral substance.

In other cases, where the blood is sent sparingly to the brain, and with the feeblest impulse,—where, in fact, the pulse at the wrist is scarcely perceptible, and the general circulation is nearly at a stand,—the brain nevertheless, preserving the action of its own vessels, and thereby maintaining its circulation, is found capable of performing some of its most important functions; and that often within a few moments of the termination of life. In fact, in all the diseases of the encephalon, it is the state of action in the cerebral vessels themselves, and hardly at all that of the general vascular system, which regulates and determines the phenomena and effects of the disease. The expression therefore, *determination of blood to the head,* in such general use, appears to be unfounded, as implying that the quantity of blood impelled to the brain, and the force of circulation there, depend in any material degree upon the heart's action, instead of the action of the cerebral vessels themselves.

Of the mode of action of the remote causes of apoplexy.—Let us now proceed to inquire how far the different remote causes of apoplexy have actually a tendency to produce the effect supposed—that of interrupting the circulation in the brain, and thereby impeding, or more or less perfectly interrupting, its functions.

The simplest remote or occasional cause of the apoplectic state is strong pressure made on the surface of the brain from without. When, for example, the skull is perforated, or otherwise rendered imperfect, and the point of the finger is pressed with a certain degree of force on the brain, the animal becomes motionless and insensible—in other words, apoplectic; and this continues till the pressure of the finger is removed. According to the theory proposed, it is obvious that such pressure must of necessity have the effect of obstructing, more or less, the circulation of blood through the organ. From the incompressible nature of the cerebral substance, such pressure may affect the vessels situated in the remotest parts of the brain, as readily as those to which the pressure is more immediately applied. Here, therefore, as far as the circulation of the blood in a part is necessary to the performance of its functions, we have an adequate cause of the suspension of functions which characterises apoplexy. In like manner, fracture of the skull, with depression of a portion of bone, or blood extravasated beneath it, equally induces an apoplectic state, by compressing the blood-vessels, and which is seldom relieved till the depressed portion of bone is elevated, and the extravasated blood removed.

Extravasation of blood, or serous accumulation in the interior of the brain, must necessarily have the same effect, by taking up space which can only be furnished by the blood-vessels yielding to the pressure thus made upon them. In all these cases it is evident that the circulation of blood through the brain must be impeded or interrupted, in different degrees, according to the extent of the pressure so applied. If this should be great, and suddenly induced, such a degree of stagnation may take place, as to be incompatible with life itself.

Again, if a tumour is formed within the skull, whether it be a morbid production of any kind, or a case of common inflammation ending in abscess, in either case space is required, which can only be supplied, either by the removal of a corresponding portion of cerebral substance by the slow process of absorption, or by the emptying of the blood-vessels of the brain, as the natural consequence of the pressure which such tumour is making on the surrounding parts.

In all the cases above described, simple observation, or dissection, will illustrate the nature of the disease, by pointing out the immediate cause of the impeded or interrupted circulation in the brain. But there are other cases of apoplexy, in which dissection detects nothing adequate to explain the symptoms; which, therefore, must be otherwise accounted for.

It has been a very generally received opinion that such an increased determination of blood to the brain may take place as to give rise to an overloaded state of its vessels, so as to disable it for the performance of its functions, or, in other words, to induce an apoplectic state.

This supposed determination of blood to the brain, and the impeded state of functions arising out of it, have been ascribed to increased action of the heart. But it has been already shown, that the brain is incapable of receiving any additional quantity of blood in its vessels; consequently, there can be no such over-fulness as has been supposed, to account for the oppressed state of the organ. And were it otherwise, the heart has no power of sending blood to the brain in greater quantity than to other parts. If the force of circulation in the brain be increased, as it undoubtedly may be, such an effect is owing to the increased action of its own vessels, and not to that of the heart. The phrase, determination of blood to the brain, is, therefore, without meaning.

Much has been said of late of venous congestion, as one of the immediate causes of the apoplectic state. This notion is founded, as before observed, solely upon the fact, that in some cases of apoplexy, the superficial veins on the surface of the brain are found gorged with blood. Hence it has been imagined that the same state of veins existed during life. It is, however, a great error to suppose that the appearances observed in the body after death are a true representation of what existed during life, especially as regards the blood-vessels. It is a general principle in physiology that the arteries, in consequence of the greater degree of contractile power naturally possessed by them, empty themselves into the veins, as their last act of life; and accordingly the blood is principally found in the veins upon dissection. This law applies to the brain no less than to other parts; and consequently the veins, which are principally situated on the surface of the brain, running between the convolutions, are always found more or less distended with dark or venous blood; while the principal arteries, situated towards the basis, are found comparatively empty. Now no one can believe that this state of the arteries and veins of the brain, relatively to each other, could exist—that the arteries could be empty and the veins full, during life; for such a state of things would be clearly incompatible with the regular movement of the blood, which requires that there should be a continuous stream throughout the vascular system. The blood which the veins contain, whatever be its quantity, must be derived from the arteries; and if there be found, after death, a more than usual quantity of blood in the veins,—if they are in a *congested state*, (to use a modern though unphilosophical expression,) or unusually gorged with blood,—it is only a proof that the arteries, at the time of death, had sent into them an extraordinary quantity of blood; and that they had probably been unusually distended during life. This is confirmed by the fact that such a gorged state of the veins on the surface of the brain is met with in those cases of disease in which the arterial action of the organ during life has been the most violent.

The term congestion, therefore, as implying an unusually distended state of vessels in the brain, applies to the arteries, and not to the veins; the gorged state of the latter taking place only at the time of death. The importance of this distinction will be seen, in laying down the treatment of apoplexy, as well as other acute cerebral diseases.

It remains to be shown, how such a distended state of the arterial system of the brain is calculated to produce the apoplectic state, by impeding the circulation through the organ. This will be best illustrated by showing how the state called intoxication, or drunkenness, is produced by alcohol, or other inebriating liquors. Alcohol, in all its combinations, and however applied to the body, proves a stimulus to the arteries of the brain; and in whatever way it produces its peculiar or specific effects, its action may be justly termed specific with respect to this organ, as it produces nothing similar, at least in an equal degree, on any other. This specific and stimulant power of alcohol with regard to the brain, is evinced by unequivocal proofs of increased arterial action in the whole head; as well as by the disturbance in the state of the sensorial functions which it occasions. The increase of action in the external carotid arteries is manifested by the stronger pulsation and increased size of both the cervical and temporal arteries, and by the flushing of the face, and redness of the eyes; all of which clearly show increased action in the branches of the external carotid: and that a similar state of excitement takes place in the internal arteries of the head and their ramifications throughout the brain, may be inferred with great probability from the increased heat of the whole head, and from the feelings of the individual, especially when recovering from the effects of intoxication; at which time there is frequently violent throbbing head-ach.

Admitting, then, that the peculiar and specific effect of alcohol is to stimulate and excite the blood-vessels of the brain to greater action, it will not be difficult to account for the different and even opposite effects of the same stimulus, according to the degree in which it is applied, and the time that has elapsed from its administration: and certainly nothing can well be more different than the effects produced by a moderate use of wine, or other strong drinks, and the highest state of drunkenness. In the one case, the greatest energy and activity are displayed throughout the system—in the other, some of the most important functions of the brain are nearly annihilated. This apparent incongruity of symptoms, however, will vanish, if we advert to the effects of stimulation on arteries in general, as applied in different degrees; and, at the same time, recal to our recollection the peculiar physical circumstances in which the brain is placed, as already noticed.

A moderate degree only of excitement of arteries merely increases their action, and augments, in consequence, the impetus and velocity of the blood through them, but without manifestly, or at least considerably, increasing their diameters. Under a more powerful degree of excitement, their diameters become enlarged; the quantity of blood in them is increased, and at the same time put into more rapid motion. These effects may be readily seen upon immersing an extremity, the arm for example, in hot water: both arteries and veins become enlarged; the blood circulates with greater force and velocity; and the bulk of the whole limb is increased.

The same law doubtless holds good with respect to the blood-vessels of the brain. There is the same tendency as in other parts to enlarge their dimensions from the application of stimuli; but with this difference, that from the peculiar circumstances in which this organ is placed, as before pointed out, there is not room for the simultaneous expansion of both arteries and veins. The arteries becoming enlarged in their diameters, as a consequence of their increase of action, occupy greater space within the skull than before, and in so doing necessarily compress the veins, these latter being the only parts that yield to pressure. It is obvious, then, that the movement of the blood through the brain must be impeded, in proportion as the veins are suffering compression; and this again will depend upon the degree of excitement and distension that exists in the arteries: and thus the different degrees and successive stages of intoxication are easily understood: in the first degree of excitement, by a moderate use of vinous liquors, the movement of the blood through the vessels of the brain is augmented; the action of the arteries being simply increased, without any material increase of their dimensions, the veins are still in a condition to receive and to transmit the arterial blood. In this state of the circulation of the brain, the sensorial functions are simply excited, but without disorder; the powers both of body and mind are displayed with greater energy; but in a higher state of excitement from the same cause, the arteries of the brain become distended, the veins are pressed upon, and the circulation is proportionally impeded. Disorder of functions then succeeds to the previous state of simple excitement; and if the stimulus be carried to the highest excess, the circulation of the brain becomes almost wholly interrupted; and the consequence soon is an entire abolition of all the sensorial functions, or in other words, the highest degree of intoxication. This state continues till the excited and distended arteries gradually subside into their former and natural state of action and fulness; when the pressure is taken off from the veins, and the circulation through the organ is renewed: with this, a restitution of its functions takes place, the stupor gradually disappearing.

Another cause of excitement of the arterial action of the brain is the hot-bath; and, still more, the direct application of heat to the naked head, as in the *coup-de-soleil*, to which we have before adverted, both of which occasionally give rise to apoplexy; which however is generally temporary in duration, and for the most part without danger; unless, from the violence of action, a rupture of vessels should take place, or inflammation should follow, when the character of the disease becomes changed. The apoplectic stupor that attends both of these cases, whether produced by the hot-bath or by insolation, admits of a ready explanation upon the principle of arterial fulness, as before illustrated.

Again, the arterial action of the brain is strongly excited by certain emotions of mind, particularly anger and joy; both of which, when excessive, have been found to induce apoplexy, and sometimes with a fatal result. They may easily be conceived to operate in the way mentioned; namely, by arterial fulness producing venous compression, and consequently interrupted circulation in the brain.

Lastly, inflammation of the brain, when general or extensive, whether it be a primary affection or arising in the course of other diseases, not unfrequently terminates in apoplectic stupor. At the commencement, just as in the early stage of *intoxication*, there is excitement, with more or less of disorder, in the sensorial functions: as the inflammation increases, the disorder of functions increases likewise; there is then frequently furious delirium. At length, stupor takes place, and the patient often dies apoplectic. Of all these changes we have frequent examples, in the cases of hydrocephalus, phrenitis, and idiopathic fever; these differ from ordinary cases of apoplexy, in possessing the characters of inflammation along with those of oppressed brain. In all, the same cause of cerebral oppression exists; namely, obstructed circulation induced immediately by arterial fulness; which, in a circumscribed space, as that of the skull, must of necessity compress the only yielding parts, the veins, and thereby impede, and in extreme cases put an entire stop to, the circulation of the brain, and thus destroy life.

Thus it appears that apoplexy may be produced by a variety of remote causes, all operating in different ways, but all leading to the same general result — obstructed circulation of the brain. Whether this be produced by direct external pressure, or by extravasated fluids, or tumours, within the skull; whether by arterial excitement and consequent distension, as produced by either alcohol, external heat, or mental emotions; — or whether by any impediment to the return of blood from the brain, by causes influencing the veins; — the effect is still the same, and suggests the same general indication of cure; namely, to restore the circulation of the brain. The means, however, of doing this will vary according to the nature of the obstructing cause, the removal of which is the principal object of practice.

It may be asked here, is there any cause (not mechanical) capable of influencing the sanguiferous system of the brain exclusively, so as to paralyse, as it were, its blood-vessels, and thereby put a *stop* to the movement of the blood in that organ? Is apoplexy ever induced in this manner? Has carbonic acid, or any of the narcotic tribe, such a power? Is natural sleep, in which the sensorial functions are all suspended, the result of diminished action in the blood-vessels of the brain, and consequent retarded movement of the blood through the organ? And may not dreaming and somnambulism be explained on the supposition that some parts of the vascular system of the brain continue in an active state, while the rest become quiescent? These are important questions, to which, however, a satisfactory answer can hardly be given in the present state of our knowledge. The insensibility induced by extreme cold may perhaps be so explained. The subject altogether merits consideration.

The prognosis in apoplexy is governed, in some measure, by the actual condition of the brain, and also by the nature of the remote cause, and the possibility of its removal. This will be best understood when we come to the particular treatment of the disease under its different circumstances. It may be observed in general, that a very large proportion of cases of apoplexy terminate fatally; some of them immediately, some after a longer interval. Those that do not prove immediately destructive to life, are often fatal on recurrence, though repeated attacks may intervene. Cases that depend upon vascular excitement merely, without lesion of structure, and without extravasation of blood, or accumulation of serum in the brain, may be judged of favourably. But as these points can seldom be determined with certainty during life, the prognosis in apoplexy is always more or less doubtful, and for the most part unfavourable.

Treatment. — There is perhaps no disease the treatment of which requires so much to be directed by theory or general principles as apoplexy. The practice in general use is, for the most part, unnecessarily violent; and, in some respects, contradictory. Bloodletting to an unreasonable extent, vomiting, purging, blistering, sinapisms, and a variety of other stimulants, have all been administered with an almost indiscriminate and unsparing hand; as if, to insure recovery, it were only necessary to have recourse to sufficiently active means, without much regard being paid to their nature or effects. The treatment thus becomes needlessly complicated and severe; and there is reason to believe that the end sought after is often thereby frustrated rather than promoted. It is necessary, in order to practise with success, to look not only to the symptoms, but to the intrinsic nature of the affection; and more especially to the various remote causes by which the disease may be induced, the obviating of which is the principal object of attention in the cure. Without these distinctions being made, the treatment becomes little more than empirical. It is above all things necessary to guard against the profuse and almost unqualified use that is made of the lancet on those occasions, apparently without consideration of what it may be really capable of effecting, and what it is incompetent to perform. By injudicious application, it will not only fail to do good, but may impede recovery, and even tend to destroy life.

Admitting that the proximate or immediate cause of apoplexy in general, as far at least as this is understood, is impeded or interrupted circulation of blood in the brain, the simple and obvious indication of cure to be followed, is to restore the circulation so obstructed; which is in general only to be accomplished by the removal of the obstructing cause. This being various, and different at different times, may require different and even opposite means for its removal. It becomes necessary, therefore, to show the individual treatment of apoplexy, in relation to its exciting or occasional cause; and for this purpose it will be useful to follow the order laid down in speaking of the various remote causes of the disease. These may be usefully arranged under three heads, viz.: 1st, such as act by mechanical pressure on the brain; 2d, such as act by producing arterial excitement and distension; and, 3d, such as occasion impediments to the return of blood from the brain by the veins.

1. *Treatment of apoplexy in reference to the first division of causes.*— When apoplexy is induced by fracture of the skull with depression, or where blood is effused immediately beneath the bone, the treatment is simple; consisting principally in the elevation or removal of the depressed portion of bone. The means of accomplishing this are within the province of surgery. The after-treatment consists in endeavouring to prevent and to remove inflammation by bloodletting and other analogous remedies.

An interruption or suspension of the sensorial functions may take place as the result of external violence, in which there is no injury done to the bone, nor other source of pressure on the brain. This has been referred to concussion simply, or the shock which the organ has sustained from the fall or blow received. The injury done to the brain in some of these cases is so great, as to prove immediately or quickly fatal; and yet, upon dissection, nothing has been found adequate to explain the effect. At other times, vessels have been ruptured, and blood found effused, sufficient to explain the apoplectic state. It is not possible, at all times, to distinguish, during life, between the effects of simple concussion, and those arising from the pressure of extravasated blood in the brain; and the difficulty is the greater from the circumstance, that the case is often complicated; the same degree of violence that occasioned a rupture of blood-vessels, almost of necessity producing a considerable shock to the brain. The distinction, in regard to symptoms, that has been supposed to exist in the two cases of concussion and extravasation, is by no means to be relied upon. Still less does there appear to be a foundation for the widely-different methods of cure, that have been proposed with respect to them. The older writers on surgery relied principally upon bloodletting in cases of supposed concussion, as well as in other injuries of the brain. The moderns, some of them at least, influenced probably more by love of novelty than real observation, condemn in toto the practice of bloodletting, and recommend, instead of it, a totally opposite mode of cure; namely, the use of opiates and general stimulants. In neither case does the view that has been taken of the subject appear to be altogether correct; nor is the practice recommended at all times consistent with reason. Experience, which has been adduced in favour of both modes of practice, cannot be implicitly relied upon. Upon the supposition that the brain has suffered only from the shock, without depression of bone, or extravasation of blood, it is not conceivable that bloodletting should be capable of affording any immediate relief. The medullary substance may have been deranged, or have undergone an imperceptible solution of continuity in the minuter parts of its structure; or its vital properties may have been simply affected, without physical or mechanical injury; but in neither case is bloodletting an indispensable remedy. There is one point of view, however, in which bloodletting may be considered of importance; and that is, in regard to its power of preventing inflammation, which is an almost necessary consequence of such violence committed on the brain. The propriety of bloodletting, however, will still be to be governed by circumstances, and especially by the state of the general vascular action; which differs considerably in different instances. In some cases of simple concussion of the brain, the general circulation is carried on very feebly; the pulse is weak and soft, with varying frequency; and the body is cold. Such a state can hardly be supposed to require, or even to bear, loss of blood. At other times, the action of the general vascular system is little altered from the natural state. In such cases, the moderate abstraction of blood would be safe and proper, as a means of preventing subsequent inflammation. It is scarcely necessary to add, that if the pulse at the wrist is fuller or stronger than natural, (as may be the case from the first, or it may take place at some period after the infliction of the injury,) there need be no hesitation as to the free abstraction of blood; limited, of course, by the general strength and other circumstances of the patient. But, admitting that bloodletting is not required in any particular case of concussion of the brain, does it follow that opiates or stimulants should be proper? What possible tendency can either of these have to relieve the injury which the brain has sustained, either with regard to its physical or vital properties? Even should the general circulation be greatly depressed, still it is not easy to see how exciting it by active stimulants should be productive of much good, as they are not likely to produce lasting good effects, nor have they any tendency to remove the cause; namely, the injury the brain has suffered. On the other hand, if largely used, they may increase the tendency to inflammation, and thus become objectionable. Upon the whole, except the employment of bloodletting in the circumstances and with the view now mentioned, the variety of apoplexy that results from what is termed concussion of the brain, admits only of very simple treatment. With the exception of inflammation, the prevention and cure of which are objects of great importance, relief can only be hoped for from time, and a quiet state of the organ.

Apoplexy arising from the extravasation of blood in the brain, (that form of the disease which has attracted the greatest notice,) cannot be certainly known during life, though it may often be suspected. When the disease occurs suddenly and with violence; or, beginning mildly, gradually gets worse; and when the stupor continues for many hours, and is then followed by only an alleviation of symptoms; there is strong ground for believing that a rupture of blood-vessels has taken place in the brain. This is a case in which bloodletting has been used with little discrimination, and often, there is reason to believe, carried to a hurtful excess. It is evident that the remedy can have no direct effect in removing the extravasated blood; nor can it lessen the quantity of blood altogether within the skull, so as to give additional space, and thereby diminish the pressure the effused blood is making on the brain; and yet it is employed in these cases as if it were capable of accomplishing, with certainty, one or other of these purposes; it is used too with such freedom, as if it needed only to be carried to a certain extent in order to insure success. But blood, once extravasated, can be removed only by absorption, which is a natural and slow process, requiring for its completion at least a moderate share of general strength. Large and unnecessary abstraction of blood in such cases, by weakening the body altogether, rather creates an obstacle to recovery than the contrary. The proper use of bleeding in such cases is, to reduce that violence of arterial action in the brain (often of a real inflammatory nature) upon which the rupture and effusion immediately depend, and thereby to prevent a further escape of blood. But for such a purpose, only a moderate though perhaps repeated abstraction of blood can be required; and then always in proportion to the age and other circumstances of the patient, and according to the stage and duration of the disease. As mere matter of experience, there is reason to believe that bloodletting in these cases does much less good, and the omission of it less injury, than is generally supposed. As to the other remedies in general use on these occasions, little can be said in their favour, while some of them are decidedly hurtful in their tendencies: such is the case with extensive blistering, or sinapisms, and internal stimulants of any considerable activity. From the very nature of the case, they can accomplish nothing beneficial; while the immoderate use of them may do harm, by exciting the general vascular action of the system. Vomiting is for the most part objectionable, and may be even dangerous, by the temporary check it gives to the return of blood from the head. Even where it is known or suspected that the stomach is in a loaded state, the danger attending full vomiting is more than a counterpoise to any benefit likely to be derived from the practice. Sneezing, which has been sometimes recommended for the relief of the stupor, is little less hazardous than the use of emetics.

The treatment of apoplexy dependent upon accumulation of serous fluid in the brain, or, as it is termed, *serous apoplexy*, requires a further consideration. It has been already stated that no absolute line of distinction can be drawn between the sanguineous and serous forms of the disease; they are, in fact, frequently found in combination, or rather to be considered as mere varieties of one and the same affection. Serous accumulations in any of the cavities of the body are in most instances the result of membranous inflammation; not in general of an acute, but rather of a chronic or protracted description. This primary dependence of serous accumulations, or dropsies as they are called, on inflammation, is not always distinctly seen, on account of the mildness of the inflammatory symptoms at first, and their having often passed away without notice, leaving the accumulation of fluid behind. Still, there are but few cases in which the connexion of dropsy with inflammation, as its primary source, may not be traced by accurate inquiry. This applies to the brain, as much as to either of the other cavities. In most apoplexies that come on slowly, and which, on this account, are supposed to be of a serous nature, signs of preceding as well as of existing inflammation in the cavity may be discovered; such as head-achs, sometimes accompanied with flushing and throbbing of the arteries about the head; together with more or less of general febrile action throughout the system, (which last is to be taken as an infallible criterion of the existence of topical inflammation in some organ,) to say nothing of the disturbance of functions which marks the seat of the disease. Mere serous accumulations, without other disease of the organ, may account for a lethargic state of the patient, but is hardly sufficient to explain the occurrence of an apoplectic fit; which, being sudden in its attack, and disposed to recur by paroxysms, must depend upon some occasional and temporary cause, and not upon the mere presence of the fluid; for this must be slowly collected, and when once formed must be permanent, or, at all events, is not likely to be rapidly absorbed. No temporary cause of such disturbance, or rather suspension, of functions as takes place in apoplexy can be suggested with so much probability as occasional arterial excitement, to which the brain appears to be particularly prone. Such a disposition to occasional arterial excitement is a natural consequence of inflammation, and may remain long after the inflammation which gave rise to it has disappeared. And thus it is that persons liable to apoplexy of this mild description, suffer a great number of slight attacks with impunity; but in general are at length carried off by one of greater violence; and then it is usually found, upon examination after death, that extravasation of blood has produced the fatal event; proving that there is no real or essential distinction to be made between *serous* and *sanguineous* apoplexy.

In the treatment of apoplexy of this nature, slow in its approaches, and occurring, as it occasionally does, in feeble habits, a mild plan of cure only is admissible. Inquiry is to be made as to the probable existence of inflammation, its degree and duration; and remedies applied accordingly. In no case, even during the fit, could a large abstraction of blood be proper. Such a remedy, supposing the fit to be the immediate result of arterial excitement merely, without a rupture of vessels, is unnecessary, as the increased vascular action will probably subside by milder means, or even spontaneously; while, should effusion have actually taken place, the largest bloodletting could effect nothing direct towards its removal, and might even prove immediately fatal. At all events, the patient would be left in a less favourable state for future recovery. It is here as in epilepsy, in which, during the paroxysm, unless the disease altogether be of recent occurrence, little can be done with advantage. It is in the intervals, for the most part, that we can hope the measures adopted will be permanently advantageous. So in apoplexy, of the description here alluded to, the paroxysm, however alarming in appearance, is either of no real importance, or, if it should be dangerous from rupture of vessels, or other injury sustained by the part, art can do little or nothing for its relief. In the intervals, and when a suspicion of inflammation no longer exists, it may be proper to aim at removing the serous deposit, by diuretics or other such methods as are not particularly detrimental to the general health. In this point of view, the employment of mercury, however highly vaunted on these occasions is of very equivocal use.

Serous accumulation in the brain appears to take place at times, as a consequence of impediments to the return of blood by the veins: hence the stupor that is observed to occur in some pulmonary affections, in which the blood is not transmitted with freedom through the lungs. This, however, is rather lethargy than apoplexy, as it does not occur by fits, unless there should be actually at the same time disease in the brain itself.

With respect to tumours, or other alterations of structure, observed in the brain of persons dying of apoplexy, such are to be considered rather as predisposing, and not as efficient, causes of the apoplectic state. Being permanent in their nature when once formed, they can afford of themselves no adequate explanation of a paroxysm or fit that is only of occasional occurrence. This, as was observed on a former occasion, must be referred to temporary vascular excitement, the disposition to which is produced and kept up by the presence of the morbid structure. Apoplexy may be suspected to be of this nature, when preceded or accompanied by symptoms denoting the existence of chronic inflammation in the brain. These morbid changes of structure are generally found in combination with more or less of serous effusion. Should apoplexy take place under such circumstances, bloodletting might be required for the immediate relief of the fit, but not to any great extent; the object being merely to diminish the arterial action of the brain, and thereby to put a stop to that temporary state of excitement which is the immediate cause of the paroxysm. In this, as in other cases, sanguineous effusion may have taken place; but of this no certain knowledge can be obtained till after death. If it were even possible to ascertain it during life, it would afford no additional ground for profuse bloodletting. Should the patient survive the fit, it is then an important object to endeavour to remedy the disorganization which we may suspect to exist in the brain, or rather to take off the inflammatory action in the part, which has produced the alteration of structure; for over the morbid structure itself art has little influence. It is, however, only in slight and recent affections of the sort, that we can hope to be successful; though much may still be done to mitigate and to check the further progress of the mischief. The means we have it in our power to employ for the purpose are few and simple. Small and repeated bloodlettings afford the best, if not the sole chance of success in such cases. To enable the patient to bear these for as long a period as may be necessary to accomplish the purpose, it is indispensable that he be allowed to take food in reasonable quantity, and of the most simple digestible kind. There is no better guide, perhaps, on these occasions, than the natural appetite, when not excited by variety or by food of a stimulant nature. It is a great mistake to suppose, either in this or in other chronic diseases requiring bloodletting, that the attainment of our object is likely to be frustrated by a moderate use of food, whether animal or vegetable in its nature. Judging from experience in chronic forms of inflammation, the contrary rather appears to be the case. An unfounded preference appears to be given to what is called local or topical bleeding over venesection. The term topical or local is quite misapplied here, as no vessel immediately connected with the brain, or that can directly influence its circulation, admits of being opened for the purpose of letting blood. It is to quantity, and the rapidity of taking away blood, that we are to look, and not the part from which the blood is taken; unless indeed it could be drawn immediately from the part affected; which is of course impracticable. The circulation of the diseased part, as far as regards the abstraction of blood, can only be influenced through the medium of the general circulation; and this we can more readily and effectually act upon by venesection or general bloodletting, than by what is termed local bleeding; simply because we have a command, both as to time and quantity, in the one case, which we seldom can have in the other. The safety of bloodletting, in both modes, depends upon quantity; but not so the efficacy of the practice. It might not indeed be prudent, or even safe, in all cases, to abstract blood so rapidly as to induce fainting. In general, this had better be avoided; both as being seldom necessary, and as generally alarming in appearance.

The other means in use for the treatment of chronic inflammatory disease in the brain, such as purgation and counter-irritation by blisters, issues, or the like, are of very inferior importance in comparison with bloodletting, in cases admitting of the latter. A long-continued and rather severe employment of mercury has to all appearance been attended with success in many instances; but in many also it has failed. In the use of it, we are not to forget its power of doing harm as well as good.

The treatment of the second order of apoplexies, those that arise simply from high arterial action and distension of the vessels of the brain, without extravasation or serous effusion, and without disorganization, is of a simpler kind, and more likely to be attended with success. Ordinary cases of intoxication, from the excessive use of strong drinks, in general require only quiet and repose for a few hours; in the course of which the vascular action of the brain subsides into its natural state, and often indeed falls below it, so that a stimulus of the same kind afterwards is found to relieve the feelings of depression that generally succeed. In aggravated cases, however, of this description, and especially in persons unaccustomed to the use of strong drinks, more active measures may be called for; such as bloodletting to a moderate extent, and purging, in order to subdue, more quickly and effectually, the vascular excitement of the brain. These should be accompanied with the moderate application of cold to the head, with a view both to its sedative and its constringing properties, in the hope that these effects may be communicated by sympathy from the external to the internal vessels of the head. There is another good reason for the employment of such means in aggravated cases of intoxication, namely, that of guarding against inflammation of the brain, which now and then results from this cause.

When the narcotic effects of opium and drugs of the same class occur in an alarming degree, a very similar mode of treatment is required. In regard to the use of bloodletting in both cases, attention must be paid to the state of the general circulation. A soft and feeble pulse, with cold extremities, would not admit of bloodletting, but might require, on the contrary, the use of simple stimulants, such as ammonia, together with frictions and external warmth. Heat of the head, and throbbing of arteries, which are often found, even where the surface and extremities are much chilled, call for the application of cold to the head, as well as in the case of intoxication. The practice generally inculcated, in cases of poisoning by opium, is to endeavour to keep the patient from falling asleep, by every possible mode of irritation; if such treatment be proper in the case of opium, one does not see why it should not be also adopted in cases of intoxication by alcohol; for the symptoms are nearly alike in the two cases. If the stupor or suspension of the sensorial functions produced by narcotic substances be owing to an excited and distended state of the arteries of the brain, irritation of any kind will only prove an additional cause of vascular excitement in the brain. It would be well if a satisfactory appeal could be made to experience, in order to decide the point of practice : but this can hardly be done, on account of the difference which exists between different cases.

Should the apoplectic state have been occasioned by isolation, the hot bath, or mental excitement, the treatment is simple. Moderate loss of blood, purgation, and the application of cold to the head, would seem to comprise all that can be really useful. If, after the lapse of a few hours, consciousness should not return, the probability will be that the violence of arterial action in the brain has been followed by the extravasation of blood; the proper management of which has been already pointed out.

Apoplexy is not an unfrequent consequence of inflammation of the brain, whether this exist in the form of membranous inflammation (hydrocephalus acutus of infants); of phrenitis; or of idiopathic fever, so called. In each of these cases, when so violent as to threaten a fatal termination, a comatose state bordering on apoplexy takes place; the apoplectic symptoms being mixed up with and modified by those of inflammation. This termination of inflammation of the brain it is not difficult to understand. In the early stage of those affections, the vascular excitement of the brain is moderate in degree, and not attended with any considerable distension of vessels. The circulation then is not materially impeded, and the functions of the organ are still carried on, though in an excited and disordered way. In the further progress of the disease, the distension of arteries increases; the circulation is by degrees obstructed; and this is soon followed by an interruption, first, of the primary functions of the brain, sensation, voluntary motion, and intellect; next, the vital functions, respiration, and the general circulation suffer, and life becomes extinct. The treatment requisite in all these cases is the same; namely, that which is adapted to subdue inflammation in general; regulated, however, by the circumstances of the patient, and most particularly by the stage of the disease. When the apoplectic state shows itself early, there is no question as to the propriety of bloodletting, and that with freedom. In an advanced stage, and especially when the general circulation is failing, this remedy becomes equivocal, and must be used, if at all, with reserve and caution.

The *third* variety of apoplexy, namely, that which arises from an interruption to the return of blood from the brain, requires a different mode of treatment from the others, on account of the different nature of the causes producing it. This is the state to which the term venous congestion has been applied, but which is nothing more than stagnation of blood in the cerebral vessels, a state which must necessarily take place if the returning current of blood by the veins be impeded or interrupted. As this interruption may be produced by different causes, there will be some difference in the treatment. In the simplest case of impeded return of blood from the brain, that occasioned by a dependent posture of the head, all that is commonly required is to raise the head. Should the stupor be occasioned by tumours in the neck, or in the course of the veins towards the heart, our being able to give effectual relief will depend upon our ability to remove or lessen the obstructing cause. In the case of violent and extensive inflammation of the lungs, where, from the swelling of parts, the blood finds its way sparingly and with great difficulty through the lungs, the impediment to the return of blood from the head, as well as other parts, is seen in the livid hue of the cheeks and lips, in the bloated state of the face and neck, and in the stupor, or imperfect performance of the sensorial functions. Along with these, the pulse at the wrist becomes soft, feeble, and often irregular; and the extremities cold. Such a state of things is nearly hopeless; for it scarcely admits of relief from art. The feeble state of the general circulation will hardly admit of loss of blood; while there are no other means that promise a better result. The practice of giving stimulants on those occasions, merely because the pulse is weak, and because bloodletting is not admissible, is supported neither by reason nor by experience: such practice is, in fact, in opposition to both.

In the more chronic cases of obstructed circulation, arising from disease about the heart and lungs, a disposition to apoplexy is gradually formed, which may destroy the patient, if he is not previously cut off by the primary disease. Apoplexy thus induced is commonly of the serous kind; it takes place slowly, from effusion consequent upon long-continued impeded circulation in the brain, and rarely admits of remedy. If, however, the primary disease in the heart or lungs is in a favourable state for the employment of remedies; that is, if the inflammation be not of very long standing, the organization not materially deranged, nor the general strength much impaired, there is still a chance that a cautiously-conducted plan of treatment, adapted to the relief of chronic inflammation, such as has been pointed out above, may rescue the patient from destruction. A result so favourable, however, is seldom to be expected.

H. Clutterbuck.

APOPLEXY, Pulmonary. The term *pulmonary apoplexy* has been adopted by modern pathologists to signify an effusion of blood into the parenchymatous substance of the lung, in consequence of the resemblance which this lesion bears to the extravasation of blood into the substance of the brain in cerebral apoplexy. But as the name of apoplexy was originally applied to a determinate group of symptoms, not to any particular form of organic lesion, we evidently divert this term from its original signification in thus making it synonymous with the effusion of blood into the tissue of an organ. However, as the term has been sanctioned by the high authority of Laennec, and is now generally adopted by pathologists, it may be as well to retain it, though certainly objectionable, as to encumber our nosological nomenclature with the term *pneumo-hemorrhagia*, recently proposed by Andral, as more aptly expressing the nature and seat of the disease, while it establishes a contrast with the term *broncho-hemorrhagia*, by which he proposes to designate the exhalation of blood from the lining membrane of the bronchial tubes.

For a long period, the rupture of a vessel was the only source of pulmonary hemorrhage recognised by pathologists; and even at the present day, the expression of *bursting a blood-vessel on the lungs* is used by many as synonymous with hæmoptysis. The cultivation of morbid anatomy has, however, tended to correct this as well as many other popular errors, and has fully established that, in a large proportion of cases, the source of the hemorrhage is to be found in a simple exhalation from the lining membrane of the bronchia. "I have repeatedly opened," says Bichat, "the bodies of persons who died during an attack of hæmoptysis, and though I examined the surface of their bronchial membrane with the greatest care, and even took the precaution of allowing it to macerate for some days before examining it with a lens, I have never been able to detect the slightest appearance of erosion, or of the rupture of a vessel."

Another source of pulmonary hemorrhage has still more recently been described by the author of the well-known treatise on Mediate Auscultation, who states, "that while the greater number of slight or moderate hæmoptyses consist in a simple exhalation of blood from the lining membrane of the bronchial tubes, the severer cases originate from a different source, and come chiefly from the vesicular structure of the lungs:" and this latter is the variety of hemorrhage to which he applies the name of *pulmonary apoplexy*. It is true that this affection had been noticed by earlier writers, and even described under its present name. Haller, in his Opuscula Pathologica, gives a brief and melancholy account of the death of a friend, who fell a victim to this disease; his description of the morbid appearances, though general, is sufficiently characteristic of the disease: "In pulmone utroque, non inflammatio, non ulcus, sed sanguinis universalis effusio fuit, ut sudore sanguineo in cellulosam fabricam effuso, et sensim collecto, nigerrima demum magna pars visuris esset." M. Lereillé read a memoir on the subject before the Academy of Sciences in the year 1816; and Doctor Hohntaum published an essay on pulmonary apoplexy at Erlangen in 1817. M. Laennec's treatise was not published until 1819: however, as the affection was entirely unknown as a common cause of hæmoptysis before the publication of his work, and as no preceding writer had given its precise anatomical characters, the merit of having first accurately described the disease must be accorded to Laennec, even though the more equivocal merit of its denomination may be contested by others.

Apoplexy of the lung, like that of the brain, presents considerable variety in the symptoms it produces during life, and the anatomical characters it presents after death; for whilst in some instances it produces no other inconvenience than the expectoration of a few ounces of blood, it in other cases proves as instantaneously fatal as the most violent attack of cerebral apoplexy. Neither are its anatomical characters less variable; for, while in its milder form its effects are limited to the sanguineous infiltration of the air-cells of one or two lobules, it occasionally pours such a deluge of blood into the substance of the lung, that the delicate structure of the organ is broken down before it, and even its investing membrane, the pleura, is ruptured by the violence of the hemorrhage.

The anatomical characters of pulmonary apoplexy as described by Laennec, are, a remarkable induration of the pulmonary substance, equal to that of the completest hepatization: the induration, however, is very different from the inflammatory affection of the lungs distinguished by this term. It is always partial, and rarely ever occupies a considerable portion of the lungs: its more ordinary extent being from one to four cubic inches. It is almost always very exactly circumscribed, the induration being as considerable at the very point of termination as in the centre. The pulmonary tissue around is quite sound and crepitous, and has no appearance whatever of that progressive induration found in pneumonia. The substance of the lung is indeed often very pale around the hæmoptysical induration; sometimes, however, it is rose-coloured, or even red, as if tinged with fresh blood; but even in this case the circumscription of the indurated part is equally distinct. The indurated portion is of a very dark red, exactly like that of a clot of venous blood. When cut into, the surface of the incisions is granulated as in a hepatized lung; but in their other characters these two kinds of pulmonic induration are entirely different. In the second degree of hepatization, we can perceive distinctly the black pulmonary spots, the blood-vessels, and the fine cellular intersectures, all of which together give to this morbid state the aspect of certain kinds of granite. In the induration of hæmoptysis, on the contrary, the diseased part appears quite homogeneous, being altogether black or of a very deep brown, and disclosing nothing of the natural texture of the part, except the bronchial tubes and the larger blood-vessels. The latter have even lost their natural colour, and are stained with blood. In scraping the incised surfaces of their parts, we can detach a small portion of very dark half congealed blood, but in a much less proportion than we can press out the bloody serum from a hepatized lung. We sometimes find two or three similar indurations in the same lung, and frequently both lungs are affected at the same time. (Laennec on Diseases of the Chest, translated by Dr. Forbes.)

Nothing can exceed the accuracy of this description, but it only applies to the milder form of the disease, when the extravasated blood is effused into the air-cells of one or more lobules, and the individual survives for a sufficient length of time, to have the fluid portion of the extravasation completely absorbed. This condition of the lung may be termed its *hæmoptoic engorgement*, to distinguish it from another form of the disease, in which the blood, instead of simply accumulating within the air-cells, ruptures their delicate parietes, breaks down the structure of the lung, and is extravasated into the lacerated tissue. It is to this form of the disease that the name of pulmonary apoplexy is more strictly applicable, as being most analogous to the condition of parts which exists in cerebral apoplexy.

This form of the disease seems to differ from the hæmoptoic engorgement only in degree, the laceration of the parenchyma of the lung, and the consequent extravasation of blood, being caused by the over-distension and rupture of the air-cells, from the excessive quantity of blood which is poured into them. Accordingly, when the hæmoptoic engorgement is extensive, or takes place suddenly, and with violence, we generally find its interior broken down, and occupied by extravasated blood. In a young man who died of organic disease of the heart in the Whitworth Chronic *Hospital*, after experiencing a violent attack of hæmoptysis about a week before his death, we found the lower lobe of the right lung occupied by a mass of hæmoptoic engorgement as large as an orange, and containing in its centre a clot of dark-coloured blood of the size of a hazle-nut; the cavity in which this clot was contained, had evidently been formed at the expense of the pulmonary parenchyma. Laennec alludes to this form of the disease in the passage, where, describing the hæmoptoic engorgement, he says, "sometimes the centre of these indurated masses is soft, and filled with a clot of pure blood." Andral has likewise noticed this variety of the disease in his treatise on pathological anatomy.

In some cases the quantity of blood effused is much larger, and a greater extent of the pulmonary parenchyma is broken down, so that a considerable portion of the lung is reduced to a soft fluctuating mass, in which there can only be distinguished some remains of the parenchymatous structure of the lung, and a quantity of effused blood, partly fluid, and partly coagulated, as in the case recorded by Corvisart (*Commentaires sur la Traité de la Percussion*) of a young man who retired to rest apparently in perfect health, and was found dead in his bed the next morning with blood streaming from his mouth and nose. On dissection, the interior of the right lung was found torn and ruptured in every direction, and gorged with an enormous quantity of dark-coloured blood; the bronchial tubes were likewise filled with the same fluid, as were also the trachea, and larynx, the throat, and the posterior nares. As examples of such extensive rupture and disorganization of the pulmonary parenchyma from extravasation of blood are of rare occurrence, we shall briefly transcribe a case of this description, which fell under our notice in the Hardwick Fever Hospital. A young delicate-looking man in an advanced stage of fever stooped out of bed to take up his spitting-pot, which had fallen; while in the act of stooping, he became giddy, lost all consciousness, and fell on the floor; he remained insensible for some minutes, but after throwing up a large quantity of blood, he recovered so far as to ask for a drink of water; he drank with avidity, and again relapsed into a state of apparent insensibility, and died within an hour, discharging a quantity of blood from his mouth and nose. On dissection, which was made in eighteen hours after death, all the air-passages from the mouth to the lungs were found filled with dark fluid blood. The right lung did not collapse when the chest was opened, except its upper lobe, which appeared healthy and of its natural colour: the middle and lower lobes were externally of a uniform deep red colour, and when pressed under the finger conveyed a distinct sense of fluctuation. When cut into, a quantity of fluid blood rushed out, bearing along with it a number of grumous clots, and several masses of broken-down pulmonary tissue. The interior of the lung presented a shreddy appearance, and resembled a sponge which had been steeped to saturation in blood.

The anatomical characters of this form of pulmonary apoplexy differ materially from those described by Laennec. The seat of the disease, instead of being circumscribed, solid, and presenting a granular surface, when cut, is perfectly uncircumscribed, feels soft and fluctuating to the touch, and when cut into, exhibits a mixture of fluid and clotted blood infiltrated through the parenchyma of the lung, which is ruptured and broken down. These differences may, however, be satisfactorily accounted for: in the hæmoptoic engorgement, as described by Laennec, the circumscribed, solid, dark-coloured masses, varying in size from one to four inches, are evidently caused by the infiltration of the blood into the air-cells of the part, and its coagulation there; as any one may satisfy himself by examining in the strong light of the sun the granular surface, which a section of the part exhibits, and by scraping it gently with a scalpel, so as to turn out the little rounded coagula from the cells in which they are moulded, after which the part will exhibit a distinct cellular structure, exactly resembling a section of the corpus cavernosum penis. The reason of the lesion being in general so accurately circumscribed, is, that the cellular tissue which invests and isolates each lobule prevents the escape of the effused blood into the adjoining lobules. The solidity of the part proceeds from the serous portion of the blood being absorbed, and the fibrinous coagulum becoming intimately combined with the tissue of the part; for in those cases where death occurs soon after the hemorrhage, the blood is uniformly found in the fluid state: and lastly, the dark colour which the hæmoptoic induration presents, may be accounted for by the stagnation of the extravasated blood, which uniformly produces this effect, as in the familiar example of an external contusion, and in Hunter's well-known experiment of intercepting a portion of artery between two ligatures, and finding, after a certain time, that the blood thus confined had lost its arterial colour, and assumed a dark venous hue. In this form of the disease there is no solution of continuity, no breaking down of the pulmonary tissue, but simply an infiltration of blood into the spongy texture of the part.

But if the texture of the organ is less resisting, or the force of the infiltrating fluid more irresistible, the pulmonary structure gives way, and the interlobular partitions which served to bound the progress of the effusion being broken down, it ceases to be circumscribed. In this form of the disease the blood is seldom wholly coagulated, and we believe never so perfectly as in the hæmoptoic engorgement. For this fact, several satisfactory reasons may be assigned. In the first place, when the hemorrhage is so violent, death generally follows before the blood has had sufficient time to coagulate perfectly, and to have its aqueous parts absorbed. It generally happens also that those extensive hemorrhages are connected with a peculiar liquid state of the circulating fluid, which diminishes its tendency to coagulate, and disposes it to pass off more freely by the exhalents, as in cases of scurvy, purpura, &c. Besides which, we may suppose that blood when effused in a large mass is not as favourably circumscribed for having its thinner part absorbed, as when minutely subdivided, and each division placed in contact with so active an absorbing surface as the walls of the air-cells.

Another variety of pulmonary apoplexy is that in which the hemorrhage not only breaks down the parenchymatous structure of the lung, but likewise ruptures its investing membrane, and bursts into the pleural sac. This is by far the rarest form of the disease; we have never seen an example of it, nor have we been able to discover more than four cases of it on record.

1. The first is related by Corvisart (op. cit.). Dr. Fortassin was found dead in his bed one morning after having retired to rest the preceding evening in the apparent enjoyment of excellent health. On dissection, the right pleural sac was found filled with coagulated blood, the interior of the right lung was also gorged with it, and its surface exhibited several rents, which extended to a considerable depth within its substance. In this case death occurred suddenly, and was not preceded by or accompanied with hæmoptysis.

2. In an analogous case, published by M. Bagh, in the Revûe Médicale, the patient was suddenly seized with violent dyspnœa; his face became pale, the pulse almost imperceptible, and death supervened in a few minutes after the commencement of the attack.

A quantity of bloody serum was found effused into the left side of the chest, and with it about a pint of dark clotted blood, which evidently came from a rupture in the base of the lung, the interior of which was lacerated and broken down, as the substance of the brain is in cerebral apoplexy.

3. The third example of this form of the disease is recorded by Andral, (Clinique Médicale,) in the case of a middle-aged man, who presented the ordinary symptoms of pulmonary consumption, attended with a slight degree of dyspnœa. One morning he was found breathing with much greater difficulty than usual, and his sputa were observed to be slightly tinged with blood: during the two succeeding days his difficulty of breathing increased considerably, the sputa became more deeply tinged with blood, and he died in an extreme state of dyspnœa. On dissection a quantity of blood and serum was found in the left pleura, the surface of the left lung was ruptured, the size of the rupture being about an inch in diameter. When the lung was laid open, a space as large as an orange was found, corresponding with the rent on the surface, and occupied by fragments of torn pulmonary tissue, mixed up with a dark grumous blood.

4. The fourth and last case of this description on record is that recently published by Dr. J. C. Ferguson, in the first volume of the Dublin Medical Transactions. A robust man, æt. 36, who had occasionally suffered from attacks of constipation and bronchitis, complained, on the 19th of June, 1829, that his cough was increased, his chest somewhat oppressed, and his expectoration, since the day preceding, slightly tinged with blood; his countenance was pale, his pulse about 90, and feeble, and his skin covered with a cold clammy perspiration. On the next day he felt relieved by the operation of a purgative. During the succeeding night he was rather restless; however he ate his breakfast as usual, and while in the act of stooping to put on his shoes, he complained to his wife of loss of vision, seemed to faint, and died without a struggle. Examination made forty-eight hours after death:—the left pleural sac contained about three quarts of blood, the serum supernatant, as in blood allowed to stand after venesection, and the clot in considerable quantity, but very soft, occupying the most dependent portion of the cavity. The lung had contracted no adhesion; the superior lobe was one mass of the most perfect pulmonary apoplexy, the structure of the lung seeming to be actually broken up by the excessive effusion of blood into it; the apoplectic mass was soft and flabby; it would scarcely bear to be incised, but broke down easily under the finger or scalpel. On the superior and posterior part of the affected lobe a laceration of the investing pleura was found, about one inch in length and half an inch in breadth, with very irregular edges, and immediately over the point where the sanguineous effusion into the substance of the lung seemed most intense, and where we might naturally expect the greatest violence to be opposed to its serous covering. A remarkable fact in the history of this case was, that he had expectorated no blood for fourteen hours before death, nor in the agony was there any escape of blood from the mouth or nares which might lead to a suspicion of the real seat of the disease. The same remark is also applicable to the preceding cases, Nos. 1 and 2, in which no hæmoptysis whatever took place before death, and the cause of the fatal catastrophe was only discovered on dissection.

The etiology of this disease is still involved in considerable obscurity. In fact, we know as little of the peculiar modification which the texture of the lung undergoes when it allows the blood determined towards it to escape from its vessels, as we do of the changes which these vessels undergo when at one time they secrete pus, and at another exhale a thin serous fluid. Andral supposes that pulmonary apoplexy differs from bronchial hemorrhage only in its situation, the former being caused by exhalation from the lining membrane of the air-cells, as the latter is by exhalation from the lining membrane of the bronchia; in fact, he supposes that pulmonary apoplexy is to bronchial hemorrhage what pneumonia is to bronchitis,—a similar disease affecting the ultimate ramifications of the bronchia instead of their primary divisions. He is likewise of opinion that in a large proportion of cases the morbid alteration to which the name of pulmonary apoplexy is applied, should not be regarded as the only source of all the blood which had been expectorated during life; on the contrary, he believes that the hemorrhage generally proceeds from a much larger surface of the mucous membrane, and that the dark indurated patches of pulmonary apoplexy are caused by the blood accumulating in those points whilst it was removed from the other parts of the bleeding surface, and expectorated as fast as it was effused there. By adopting this view of the subject, we are enabled to understand those cases of violent and profuse hæmoptysis, in which, after death, the extent of the hæmoptoic engorgement is found very small, and not at all commensurate with the quantity of blood which had been expectorated during life. The quantity of blood discharged in this way is sometimes so very great, that Laennec conceived it impossible to account for it without admitting that the blood in such cases experiences a sudden dilatation. This speculation, however, as well as other theories respecting the state of the blood and its capillary vessels in hemorrhage, will be with more propriety discussed in the general article on that subject.—See HEMORRHAGE.

The occasional causes of pulmonary apoplexy are, in general, the same as those of hemorrhage from the bronchia. (See HÆMOPTYSIS.) It is to be remarked, however, that the spitting of blood which accompanies the formation of tubercles, is most frequently of the latter species; while that which occurs in subjects affected with organic disease of the heart is most commonly of the former kind: the suppression of habitual discharges, such as the menses, hemorrhoids, or epistaxis, may give occasion to both kinds indifferently. Plethora—the sudden or long-continued impression of excessive heat or cold, ought also to be mentioned among the occasional causes of this, as of many other diseases of a very different kind; but in most instances such causes would not of themselves have been sufficient to produce the disorder, without some peculiarity of constitution in the individuals. (Laennec, *op. cit.*)

Of all these, organic disease of the heart is decidedly the most common. Of twenty-two cases of pulmonary apoplexy that we have examined after death, fifteen, or rather more than two-thirds of the whole, occurred in individuals labouring under heart disease; in two instances only was the pulmonary apoplexy connected with tubercles in the lungs; in one individual the disease was caused by external injury; in four cases we were unable to trace the hemorrhage to any local impediment to the circulation, or to any organic disease either of the heart or lungs. Andral likewise states, as the result of his experience, that organic disease of the heart is decidedly the most common cause of pulmonary apoplexy: (op. cit.) Cruveilhier relates two cases of pulmonary apoplexy, (*Dict. de Médecine*, &c.,) both of which were connected with organic disease of the heart. Of two cases recorded by Bouillaud in the Archives Générales, one was connected with disease of the heart, the other with hepatization of the lung. Mr. Burns, in his work on Diseases of the Heart, has also noticed the frequent connexion between these diseases. "The pulmonic vessels," says he, (page 53,) "by the congestion and continued vis-a-tergo, are ruptured, blood is forced into the air-cells, or, if urged still further, all the cellular structure of the lungs is crammed with blood: these organs cut like liver, and sink when put into water." Bertin, likewise, in his "*Traité des Maladies du Cœur*," particularly notices the influence of certain diseases of the heart in producing pulmonary apoplexy. According to this author, hypertrophy of the right ventricle has the same tendency to produce apoplexy of the lung, that hypertrophy of the left has to cause apoplexy of the brain; and by the same mechanism; for as the brain directly receives the shock of the column of blood which is propelled by the aorta through the left ventricle, so the lungs receive directly the shock of blood which is propelled through the pulmonary artery by the right ventricle. Accordingly, when the parietes of the right ventricle acquire an increased volume and proportionate increase of energy in their contractions, the blood is propelled through the pulmonary vessels with such an increased degree of force as is sometimes sufficient to over-distend and rupture their parietes. The hemorrhage produced in this way he considers to be of an active character, and essentially different from the passive hemorrhage which results from the over-distension and rupture of the pulmonary capillaries, arising from the mechanical congestion of the lung caused by narrowing of the left auriculo-ventricular orifice. Of all diseases of the heart, these have the strongest tendency to produce attacks of pulmonary apoplexy, in consequence of the direct influence they exert over the pulmonary circulation; but the same effect may likewise be produced by any disease of this organ which obstructs the free transmission of the blood. We have seen two cases of pulmonary apoplexy connected with hypertrophy of the left and passive dilatation of the right ventricle.

In a great majority of cases the occurrence of pulmonary apoplexy may no doubt be traced to the agency of some of the causes just enumerated, and may therefore be considered as a secondary or symptomatic affection. But there are likewise cases of this disease, in which the cause of the determination of blood to the lungs, and its escape from the capillary vessels, is not preceded by any marked derangement in the pulmonary circulation or other premonitory symptom, and must therefore, in the present state of our knowledge, be regarded as a primary or idiopathic disease, though in all probability it is only the manifestation of some more general or constitutional derangement, particularly in those cases where apoplectic extravasations are formed in several organs at the same moment, as in the head, liver, and lungs, (Andral,) and in the case alluded to by Laennec, where he found large extravasations of blood in the cellular membrane of every limb, of the trunk, and of the greater number of the abdominal viscera. How far it may, in such cases, depend on a morbid alteration of the fluids, or on some disease of the nervous or vascular system, it is not our province at present to inquire, as these considerations will find their place in the general article on hemorrhage. Certain, however, it is, that many cases of pulmonary apoplexy occur, which cannot be referred to any of the occasional causes enumerated by authors: indeed, the greater number of these overwhelming apoplexies, *apoplexies foudroyantes* of the French, are of this class. Of the six cases of apoplexy proving suddenly fatal, recorded in this article, three were in the enjoyment of perfect health up to the moment of the apoplectic seizure; a fourth, described as occurring in a robust man in the prime of life, had occasionally suffered from attacks of bronchitis and constipation; a fifth was in an advanced stage of typhus fever; and in one case only could the hemorrhage be referred to any organic disease of the thoracic viscera.

The *diagnosis* of pulmonary apoplexy is, in many cases, a matter of considerable difficulty. When the patient dies suddenly without hæmoptysis, as in cases No. 1 and 2 already recorded, it will often be impossible to determine, except by inspection, whether death was caused by cerebral or pulmonary apoplexy, or by rupture of the heart: and even in those cases where the fatal attack is accompanied with hæmoptysis, the physician will sometimes find considerable difficulty in ascertaining the source of the hemorrhage, as the bursting of an aneurismal sac into the bronchia may produce effects precisely similar. In the more common and less violent forms of the disease, in which an accurate diagnosis is of much more practical importance, the symptoms most pathognomonic, as enumerated by Laennec, are, violent sense of oppression in the chest; great difficulty of breathing; cough, accompanied with irritation of the larynx, and sometimes by very acute pain of the chest; expectoration of bright and frothy, or black and clotted blood, quite pure, or mixed with salivaor mucus; frequent full pulse, with a particular kind of vibration even when soft or weak, as it frequently is after a day or two. There is rarely any positive fever, and the heat of the skin continues natural, or nearly so; frequently the heart and arteries yield the bellows-sound to a very marked degree. Of all these symptoms the spitting of blood is the most constant and most severe, and returns by fits, accompanied with cough, oppression, anxiety, intense redness or extreme paleness of the face, and coldness of the extremities. When the hemorrhage is very great, it comes on sometimes with a very moderate degree of cough, accompanied by a convulsive elevation of the diaphragm, like that which takes place in vomiting. (Op. cit.)

But of all this assemblage of symptoms, there is not one, not even the hæmoptysis, which is constantly present; and they may all occur conjointly without necessarily inferring the existence of pulmonary apoplexy. Hæmoptysis is decidedly the most constant, and when very copious, the least equivocal symptom; but there are abundant instances of pulmonary apoplexy occurring and even proving fatal with only slight hæmoptysis, or even without any expectoration of blood, and likewise of profuse hæmoptysis without any apoplectic extravasation. Laennec observes that the slighter cases of hæmoptysis depend upon a simple exhalation from the bronchia, but that those cases of violent and extreme hemorrhage which often resist all medical treatment, almost invariably proceed from the vesicular structure of the lung. This distinction will be found generally correct, but still the quantity of the hæmoptysis cannot be taken as a certain index of the seat of the disease; for the same author observes that, when the hæmoptoic engorgement is limited to the extent of one or two square inches, the affection may be latent and unaccompanied with any spitting of blood. We have seen four cases of this kind in which no blood had been expectorated during life, and it was only on dissection that the existence of hæmoptoic engorgement was discovered. Andral has likewise seen several cases of pulmonary apoplexy, in which the quantity of blood expectorated did not exceed a table-spoon full at a time; and in the more aggravated forms of the disease, death is occasionally produced before a single drop of blood has been expectorated, as has been already proved by several examples cited in a preceding part of this article. On the other hand, the most profuse hæmoptysis may take place from the bursting of an aneurismal sac, from the rupture of a large vessel in a tuberculous abscess, or by simple exhalation from the mucous membrane of the bronchia. The quantity of blood expectorated can therefore only afford presumptive evidence of pulmonary apoplexy; in order to ascertain positively its existence, we must have recourse to the signs furnished by auscultation and percussion. These signs are dulness of sound in that part of the chest which corresponds with the seat of the disease, and the total absence of all respiratory murmur in the same circumscribed space, together with a crepitating râle around this space; this râle, which here indicates a slight infiltration of blood, is always found at the commencement of the disease, but is frequently wanting in the latter stages. When these signs co-exist with pulmonary hemorrhage, we may be assured that the seat of the hemorrhage is in the substance of the lung, and not simply in the bronchia. Besides these, which may be considered as the pathognomonic signs of pulmonary apoplexy, there is likewise, especially at the root of the lungs where the larger bronchia are situated, a mucous râle with bubbles, which seem to be large and thin, and formed by a matter more liquid than mucus; they also burst more frequently, and with a peculiarity of sound which cannot be mistaken. As the most common seat of this disease is in the central parts of the lower lobe, or towards the middle and posterior part of the lungs, it is consequently on the posterior and inferior part of the chest, that we ought to search for them with the stethoscope. (Laennec, *op. cit.*)

The rationale of these signs is sufficiently obvious; the dulness of sound and extinction of the respiratory murmur are caused by the sanguineous infiltration of the spongy texture of the part preventing the ingress of air, and converting its porous texture into a dense solid substance. The crepitating râle in the immediate vicinity of the hæmoptoic engorgement in all probability arises from the bursting of the air-bubbles as they pass through the uncoagulated blood contained in the adjoining air-cells, as the bubbling or mucous râle results from the bursting of the larger bullæ in the bronchia.

If these physical signs could uniformly be detected in every case of the disease, the diagnosis of pulmonary apoplexy would be sufficiently simple; for the hæmoptysis and general history of the case would serve to distinguish it from any of those diseases which exhibit the same stethoscopic phenomena, such as lobular pneumonia or clustered tubercles. It is evident, however, that neither the dulness of sound nor the absence of respiratory murmur can be detected when the hæmoptoic engorgement is of small extent, especially if situated, as it often is, in a central part of the lung, or in that portion of the organ which rests upon the diaphragm; for the healthy pulmonary tissue interposed between the seat of the disease and the parietes of the chest, must effectually mark the morbid sounds. For this reason the stethoscope rarely affords any positive information in those cases of pulmonary apoplexy, where the hæmoptoic engorgement is confined to a few isolated spots, and even in more extensive cases of hæmoptysis it too often fails to point out the precise source of the hemorrhage. In several cases of violent and copious hæmoptysis, when, from the extreme state of dyspnœa and great constitutional disturbance, we had every reason to suspect the existence of an hæmoptoic engorgement, we have found the sound on percussion not perceptibly altered, and have been unable to detect any other stethoscopic evidence of the disease than a loud mucous râle, which only served to indicate the presence of blood in the bronchia, but afforded no information as to the source from whence it came. The same difficulty of determining in certain cases whether hæmoptysis proceeds from bronchial hemorrhage or from pulmonary apoplexy, has likewise been experienced by many other persons well versed in the use of the stethoscope. M. Cruveilhier even goes so far as to say that no information is to be obtained from auscultation in such a case—"Quant à l'auscultation et à la percussion elles ne m'ont rien appris." (*Dictionnaire de Médecine, &c.*) In this opinion, however, we can by no means coincide; for by the aid of the physical signs laid down by M. Laennec, we have been enabled, in several instances, to ascertain with precision the nature and extent of the hæmoptoic engorgement.

The danger to be apprehended from pulmonary apoplexy, must, as in other forms of hæmoptysis, depend in a great measure on the cause of the hemorrhage, the quantity of blood lost, and the previous state of the patient's health. (See HÆMOPTYSIS.)

When the hemorrhage supervenes during the course of an organic affection of the thoracic viscera, such as disease of the heart, or the developement of tubercles in the lungs, the nature of that affection must of course be taken into consideration in forming our estimate of the probable result: in like manner, when it occurs as a vicarious discharge, or as the effect of violent exertion, general plethora, or any other appreciable cause, the prognosis must depend materially on the nature of such cause, and the power we possess of removing or controlling it, so that it shall not again produce a repetition of the hemorrhage.

But, in all cases of pulmonary apoplexy, the prognosis should, *cæteris paribus*, be more guarded than in those forms of hæmoptysis, where the hemorrhage proceeds from the bronchia, and the blood is removed from the lungs as fast as it is effused; whereas in pulmonary apoplexy, the blood accumulates in the parenchymatous substance of the lung, and often renders a considerable extent of that essential organ unfitted for the purpose of respiration: besides which, the blood effused into the air-cells may in some degree be regarded as a foreign body capable of producing various morbid alterations.

Laennec states that resolution of the hæmoptoic engorgement takes place with considerable facility, whatever may be the severity of the disease. In those instances where he had an opportunity of tracing the progress of this resolution by dissection, he found that the indurated parts passed successively from dark red to brown or pale red, and that, in proportion as the colour faded, the parts lost their granular texture and density. When the resolution is complete, it leaves no trace of the disease in the pulmonary substance: (op. cit.) This favourable termination of the disease may be known during life, by the progressive improvement which takes place in the patient's respiration and general health, by the sound or percussion becoming gradually clearer as the resolution advances, and by the crepitating râle becoming audible over the surface of the hæmoptoic engorgement: it is not, however, so constantly audible in this disease as during the resolution of pneumonia. In a few cases of pulmonary apoplexy where we had an opportunity of watching the progress of the resolution, we were unable to detect either the crepitating or sub-crepitating râle, but the sound on percussion became gradually clearer, and the respiration, which was at first extremely faint, slowly returned to its natural state. M. Boillaud records a case—a solitary instance we believe—in which a clot of pulmonary apoplexy was found surrounded by a well organized cyst, precisely similar to those which are occasionally developed round apoplectic extravasations in the brain, and which, like them, was probably destined to become an agent of absorption. (*Observations pour servir à l'histoire d'apoplexie pulmonaire par M. J. Bouillaud.*)

Besides these, which may be regarded as the favourable terminations of hæmoptoic engorgement, others of a less favourable nature have also been described by pathologists. Thus, according to Andral, "It sometimes happens that the blood extravasated into the lung, instead of being absorbed, has a tendency to acquire a right of settlement there by becoming organized, and thus rendered capable of performing the different acts of nutrition and secretion;" in this state it may become a nidus for the developement of different morbid productions, such as tubercle, melanosis, pus, &c. We are disposed to think, however, that the developement of tubercles can seldom be traced to this source, as in eighty-six cases of phthisis, of the dissections of which we have kept pretty accurate notes, we only find mention made of an hæmoptoic engorgement having been found in two individuals; and even in these instances it is just as probable that the tubercles may have caused the apoplectic extravasations, or that both may have been effects produced by a common cause. Laennec likewise observes, (op. cit.) that the hæmoptysis which precedes or accompanies the symptoms of confirmed consumption, arises much more frequently from bronchial hemorrhage than from pulmonary apoplexy; and the accuracy of this observation has been confirmed by Louis and Andral.

The suppuration of the apoplectic mass, and its evacuation by the bronchia, have been enumerated by M. Cruveilhier (op. cit.) among the terminations of this disease. As, however, this opinion is not supported by observation, and is directly contradicted by Broussais (*Phlegmasies Chro-*

niques), we may conclude that its occurrence is exceedingly rare, if indeed it ever takes place.

Lastly, pulmonary apoplexy has been observed to occur as a precursory symptom of gangrene, and may, we conceive, in some cases contribute to produce it. In one instance particularly we were enabled to follow the different stages of the disease from the formation of an extensive hæmoptoic engorgement to its conversion into a large gangrenous abscess.

The rationale of this transition may, we conceive, be explained thus: in the hæmoptoic engorgement the circulation through the indurated mass is completely obstructed by the solidification of the part, and by the vessels leading to it being plugged up with coagula of fibrine. This plugging up of the vessels has been noticed by Laennec, and more particularly by Bouillaud, (op. cit.) and we have repeatedly ascertained the fact on dissection. Now if we compare the condition of the part thus circumstanced with the pathology of gangrene as laid down by the most recent and approved authorities on the subject, we shall find it placed under precisely the most favourable circumstances for passing into gangrene, or, as the disease has been more appropriately designated by Dr. Low, *putrefactive disorganization* of the lung.

"I have already shown," says M. Andral, (Treatise on Pathological Anatomy, translated by Dr. Townsend, page 513,) "that gangrene is not necessarily preceded by any violent degree of irritation, but may be produced by any cause which retains the blood in the capillaries of the part, especially if by such stagnation the arrival of fresh blood by the arteries is prevented. In some persons the slightest stagnation of the blood has a remarkable tendency to be followed by gangrene of the part: this disposition to gangrene, which in these persons is constitutional, may be produced in others by a variety of causes; and in Cruveilhier's folio work on morbid anatomy we read the following account of the pathology of gangrene:—"Gangrene is a morbid condition which may occur primitively in any tissue of the body, or consecutively in any organic disease, such as inflammation, cancer, tubercle, &c. In fact it always supervenes whenever the course of the blood is intercepted either by a mechanical obstacle, or by the *obstruction of the principal and collateral arteries or veins*." (*Anatomie Pathologique du corps humain, 3me livraison.*)

The consideration of this subject will be more fully resumed in the article gangrene: we have only alluded to it at present, because, if we admit the possibility of gangrene supervening on a hæmoptoic engorgement, our prognosis must always contemplate the possibility of such an event, especially when the engorgement is extensive, and occurs in those conditions of the constitution which have been observed to be most favourable to the formation of gangrene.

The treatment of this disease must of course be regulated, in a great degree, by the age, constitution of the patient, and the quantity of blood already lost; the cause of the hemorrhage must likewise be taken into consideration, in order that the treatment may be adapted to the nature of the disease, and not to the name it bears. The measures pursued for the cure of pulmonary apoplexy when connected with purpura, or scurvy, must differ very materially from those which are employed when it proceeds from plethora, or hypertrophy of the heart.

As a general rule, however, it may be laid down, that the principal indications to be fulfilled in the treatment of this disease, are to arrest the further progress of the hemorrhage by the prompt employment of such measures as are best calculated to reduce plethora, moderate the action of the heart and arteries, and change the determination of blood, and in the next place, to prevent a recurrence of the hemorrhage by removing, or where that is impracticable, controlling those causes which may in any way tend to reproduce it, as, by re-establishing any habitual discharges, whose suppression may have led to the vicarious hemorrhage, or by removing, or at least palliating any organic disease, or constitutional disturbance with which the hemorrhage might have been originally connected. The diseases both local and constitutional with which pulmonary apoplexy is usually connected have been already enumerated among the causes of this affection; it is therefore unnecessary to repeat them here: the treatment adapted to each will be detailed in their respective articles.

As we shall have occasion, when treating of hæmoptysis, to enter fully into the consideration of the different remedial agents that have been found most efficacious in suppressing pulmonary hemorrhage, we shall, in order to avoid repetition, refer the reader to the article on that subject, only remarking that, as the hemorrhage is in general much more profuse in this variety of the disease than in bronchial hemorrhage, and as the accumulation of blood in the parenchymatous structure of the lung is always attended with considerable danger and distress, and the resolution of the indurated part at best a slow and uncertain process, our treatment should be proportionally prompt and decisive. With this view it is advisable to open a vein largely, and draw blood freely, at the very onset of the disease. The application of leeches has generally been found a very inefficient substitute for the free use of the lancet. Dr. James Clark states that, in plethoric individuals threatened with apoplexy or hæmoptysis, the application of leeches frequently decides the very occurrence of the disease it was intended to prevent: (note to Dr. Forbes's *translation of Laennec.*) A very small bleeding from a vein may also, as Laennec observes, produce the same effect: according to this author, one bleeding of twenty or twenty-four ounces on the first or second day will have more effect in checking the hemorrhage than several pounds taken away in the course of a fortnight. It is even beneficial in general to induce partial syncope by means of the first bleeding; and he adds that in cases of this kind the fear of exhausting the patient's strength is without grounds, since we know that the most copious venesection falls short of the loss of blood sustained from pulmonary hemorrhage in young and robust subjects even in the course of a few minutes; while the debilitating effect of the hemorrhage is infinitely greater than the loss of blood produced by the lancet. Should the hemorrhage continue after the pulse has become small and weak, and the strength much reduced, it will not be prudent to employ farther venesection, but to have recourse to derivatives, among which purgatives are unquestionably the most efficacious. A drastic enema or cathartic frequently checks the hemorrhage, and even the hemorrhagic *molimen*, especially if they are productive of faintness. Nauseating doses of tartar emetic have likewise been found beneficial in controlling the circulation. The acetate of lead, too, has been highly extolled in this disease for its sedative and styptic qualities. Dr. Mackintosh states that he has seen it, when administered in full doses, act in the most wonderful manner in suppressing even those hemorrhages which were afterwards proved by dissection to have proceeded from a ruptured blood-vessel in the lung, (Mackintosh's *Practice of Physic ;*) and he strongly recommends it in those cases of pulmonary apoplexy where the patient has lost too much blood before we are called, or where the hemorrhage continues after sufficient bleeding. Prussic acid will also be found useful in controlling the inordinate action of the heart and arteries, which not unfrequently subsists after much blood has been lost, and likewise in allaying the teazing cough and irritation in the throat, which are sometimes very troublesome in this disease. We have likewise found digitalis useful in this way, particularly in those cases where the pulmonary affection was connected with diseases of the heart. It is scarcely necessary to add that the antiphlogistic regimen must be strictly enforced, and that rest, silence, and cool air are indispensable.

R. TOWNSEND.

[APPENDIX VERMIFORMIS CÆCI, INFLAMMATION OF THE. See ENTERITIS.]

ARTERITIS. Much difference of opinion has subsisted amongst authors respecting inflammation as occurring in the interior of the heart and arteries. Some, amongst whom Laennec holds the most distinguished place, have thought it extremely rare ; others have attributed to it nearly all the morbid appearances and changes that are found in those parts. It will be convenient to consider the subject under the separate heads of acute and of chronic arteritis, ranging under each its proper anatomical characters, and the morbid alterations that appear to belong to it.

ACUTE ARTERITIS.

The anatomical characters of acute arteritis are, redness of the internal membrane of the heart and arteries, an effusion of plastic, pseudo-membranous lymph on its surface, and thickening and ulceration of its substance. Each of these characters will be considered in succession.

Redness of the internal membrane of the heart and arteries.—This is sometimes inflammatory, and sometimes not. The redness not inflammatory often appears in the aorta, the pulmonary artery, and the heart, and is a uniform intense colour, as if stained by the blood. Corvisart avows that he cannot give a satisfactory account of its nature and cause. (Corvisart, p. 36.) P. Frank regarded it as an inflammation of the arteries, which, according to him, occasions a peculiar and almost always fatal fever. (De Curand. Homin. Morbis, tom. ii. p. 173.) Bertin and Bouillaud have considered it, whatever was its shade, as the result of inflammation. (Traité, &c. p. 55.) Laennec entertains an opposite opinion, and demonstrates satisfactorily that the redness in question, when not accompanied by other anatomical characters of inflammation, is the result of sanguineous imbibition. This opinion has been confirmed by the discoveries of Dutrochet.*

As it is necessary that the reader be able to judge for himself, we shall give some account of this redness, adhering to the description of Laennec, which we have verified by repeated experiments and dissections.

The redness is sometimes scarlet, and sometimes brown or violet. The scarlet redness of the interior of the arteries is often confined to the internal membrane exclusively ; and, when that membrane is removed by scraping with the scalpel, the fibrous coat is found underneath as pale as in its natural state. But in other cases the redness penetrates more or less deeply into the fibrous coat, and sometimes reaches, in parts, even the cellular or external tunic. The redness of the internal coat is a perfectly uniform tint, similar to that which would be presented by a piece of parchment painted red. No trace of injected capillaries can be distinguished in it, but the tint is sometimes deeper in one part than another. Sometimes it diminishes insensibly from the origin of the aorta to the place where the redness ceases ; but very often it terminates suddenly, and by forming abrupt borders of an irregular shape. Sometimes, in the midst of an intensely red portion, is found an accurately circumscribed patch of white, which produces precisely the effect that is occasioned by an impression of the finger on a part of the skin affected with phlegmon or erysipelas. When the aorta contains very little blood, the redness only exists in the tract in contact with it, and forms a sort of ribbon. The origin and arch of the aorta are the parts of that artery which are the most frequently found thus reddened. Sometimes nearly all the arteries present the stain. The aortic and mitral valves then participate in it, and appear as if they had been plunged in a red dye. Though the red is scarlet in the arteries, it is deeper on the valves, approximating slightly to purple or violet. When the pulmonary artery is reddened, its valves and the tricuspid are also very commonly stained in the same way. The stain of the right cavities and vessels of the heart is always of a deeper an browner hue than that of the left ; a circumstance dependent, in all probability, on the darker colour of the venous blood. The internal membrane of the ventricles and auricles sometimes does not present any sensible change of colour, even when the valves are the most deeply reddened. Still, it is not rare for the internal membrane of the auricles to participate in the redness, and in this case its tint resembles that of the valves. More rarely, the surface of the ventricles also presents a similar redness, but ordinarily it is browner or more violet. Sometimes the internal surfaces of the ventricles and auricles are the only parts reddened ; but this never occurs except when the heart is gorged of blood, and the arteries contain scarcely any. The redness above described is not accompanied with any sensible thickening or vascular injection of the stained membranes. A few hours' maceration in water suffices to make it totally disappear.

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* Dutrochet, Nouvelles Recherches sur l'Endosmose et l'Exosmose. Paris, 1828.

Such are the characters of the scarlet redness. We next come to the brownish or violet stain. It is found equally on the aorta, the pulmonary artery, the valves, the auricles, and the ventricles. Most commonly, indeed, it is observed in all these parts at once. It is often very unequal in intensity, and is always more marked on the parts of the vessels that, according to the laws of gravity, have been most in contact with the blood. It is not so commonly restricted to the lining membrane as the scarlet redness; for the muscular substance of the auricles and ventricles, and even the fibrous tunic of the aorta and pulmonary artery participate in the dye; at least, in some points, and to a certain depth.

Such is Laennec's account of redness of the internal membrane. But redness, he contends with great justice, is not sufficient to characterise inflammation, particularly when it is not accompanied by thickening or vascular injection of the reddened parts. Moreover, the exact circumscription of the redness in some cases, and its abrupt termination by geometrical though irregular lines —an appearance never seen in inflammation of serous membranes, though it is occasionally and to a slight degree in that of mucous*—banish the idea of inflammation, and rather convey that of a stain by a coloured liquid which had run irregularly on the reddened membrane, or which, on account of its deficient quantity, had not been able to touch every part. Again, the circumstances under which the redness is usually found, countenance the idea of its being a stain rather than from inflammation.

Laennec has found the scarlet red to occur after a somewhat protracted agony in subjects still vigorous, but yet cachectic, in consequence of disease of the heart or otherwise. The blood in these cases was never very firmly coagulated, and the body most frequently presented some signs of decomposition. The brownish or violet red he found in those subjects especially who had died of continued typhoid fevers, of emphysema of the lungs, or of disease of the heart. Almost all had experienced a long and suffocative agony; in all, the blood was very liquid and evidently altered, and signs of premature decomposition existed in the bodies. We have found it also very constantly in cachectic subjects affected with passive hemorrhage from the gums, from ulcers, &c. as in scurvy. It is moreover, in summer particularly, and in subjects that are opened more than twenty-four hours after death, that the dark discoloration is most frequently met with. Both varieties of redness, and particularly the brownish or violet, are accompanied with a greater or less degree of softening of the heart, and with an increased humidity of the arterial walls. In most instances these states are evidently the effects of a commencement of putrefaction. Laennec has strong doubts whether the scarlet redness ever produces symptoms sufficiently severe and constant to render it capable of being recognised. He has found it in subjects who had died of widely different complaints, and he was never able to predict it by any constant sign.

The cases which Bertin and Bouillaud have adduced in substantiation of their opinion, that the redness in question is of an inflammatory nature, are strikingly corroborative of the views of Laennec. For, of twenty-four cases, eleven are typhoid fever, or other affections in which there was a manifest alteration of the liquids, and premature putrefaction. The thirteen other cases consist almost entirely of consumptive patients; and the writers observe, in general terms, that the redness appeared to coincide with a remarkable fluid state of the blood. It must further be remarked, that most of their examinations were made in summer, and more than thirty hours after death.

In order to ascertain experimentally whether blood could occasion a stain, Laennec enclosed a quantity in a sound and recent aorta, and placed the preparation in the stomach of the subject, in order to preserve it from drying, and to put it under the same circumstances of decomposition as the rest of the body. In twenty-four hours it presented a perfect specimen of the scarlet dye, which was not weakened by reiterated washing. According to his experiments, blood too firmly coagulated causes imbibition feebly and slowly. Blood half coagulated, and particularly the blood still slightly florid, which may be pressed out of the lungs, produces the scarlet redness. Very liquid blood, and particularly that with a serous intermixture, produces a violet colour of greater or less depth. If the artery be only partly filled, the dye occupies those parts alone which are in contact with the blood, and forms a ribbon. If the walls of the artery are firm and elastic, the dye requires a long time (seventy or eighty hours) for its formation, and is never very deep; but if, on the contrary, the walls are soft, supple, and charged with humidity, the dye promptly penetrates through the whole thickness. Warm weather and the rapid progress of putrefaction are favourable to the imbibition.

Boerhaave and Morgagni attributed the red colour to the stagnation of blood which takes place during the agony in diseases accompanied with great oppression; and Hodgson maintains that arterial redness, such as that above described, does not arise from acute inflammation, as it is not accompanied by any other anatomical characters of inflammation. When occurring in the vicinity of coagula, it is, in his opinion, an effect of imbibition after death.

It is impossible not to conclude from all the evidence now adduced, that redness of the internal membranes of the heart and arteries cannot alone prove inflammation, and that it is a phenomenon taking place during the agony, or after death, whenever it is found in conjunction with the following circumstances: namely, a prolonged and suffocative agony; manifest alteration of the blood; and a somewhat advanced decomposition of the body.

Such is the redness of the internal membrane of the heart and arteries which is not inflammatory: we now proceed to that which is. The colour of the latter may be the same; for the membrane, though inflamed, is still liable to imbibition. In the absence of imbibition, the redness is fainter, less shining, more equably diffused, and less characterised by streaks, patches, isolated unstained spots, and abrupt edges.

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* We have seen it in the trachea in variola. See also Bretonneau on Diphtherite.

EFFUSION OF LYMPH ON THE INTERNAL MEMBRANE, WITH THICKENING OF ITS SUBSTANCE.

Whether the redness be due to vascularity alone, or to this conjoined with imbibition, its inflammatory nature is known by the presence of certain other anatomical characters of inflammation. These are, thickening, swelling, and puffiness of the inner membrane; and effusion of lymph on either its free or adherent surface; and a preternatural vascularity, with softening and thickening, of the middle arterial coat. Each of the coats may be separated from the other with much greater facility than natural by scraping with the nail or scalpel. The internal and middle coats, in short, present all the phenomena of the adhesive inflammation, as it occurs in other membranes. It is by this inflammation that, if an artery be wounded or divided; if it be compressed by a ligature or tumour; or if it be simply irritated by ulceration of the surrounding parts or a pulmonary vomica, and effusion of lymph takes place *into* the cavity of the vessel, and into the cellular tissue, both investing it externally, and connecting its several coats, by which its caliber is obliterated and hemorrhage prevented.

Although obliteration never takes place in the aorta from inflammation alone, this vessel sometimes exhibits the vestiges of acute inflammation more palpably than smaller arteries. Thus, in a case seen by Dr. Farre, the internal coat of the aorta was of a deep red colour, and a considerable effusion of lymph had taken place into its cavity. The lymph was very intimately connected with the internal coat. (Hodgson on the Arteries, p. 5, plate 1, fig. 5.) Similar instances have been seen by Hodgson, (Ibid. p. 6,) Bertin, (Case ii. p. 7,) and apparently by Portal, (Cours d'anatomie médicale, tom iii. p. 127,) and Morgagni and Boerhaave, (Morgagni, Epist. xxvi. Art. 36;) and lymph has been found effused within the auricles and on the valves by Baillie, (Morbid Anat. Edit. 5, p. 85,) Laennec, (De l'Auscult. tom. iii. p. 127,) Burns, (On Diseases of the Heart. ch. ix.) We have met with it both in the heart and aorta. Effusions of lymph within the heart and great arteries, however, are very seldom witnessed; and hence it is, that Laennec thinks inflammation of the internal membrane of those parts extremely rare. (De l'Auscult. tom. ii. p. 598.) But the presence or absence of lymph is not sufficient to determine whether inflammation exist or not; for, in many instances, the lymph, when first effused, is washed away by the force of a circulation so powerful as that in the heart and aorta. Laennec considers a layer found on the internal membrane of the heart or great vessels, to be the only incontestable sign of inflammation of that membrane, and, with ulceration, the only certain one, (Ibid. p. 607:) for he doubts whether redness of the membrane, even when conjoined with thickening, swelling, puffiness, and an unusual development of small vessels in the middle tunic, would satisfactorily prove inflammation in a subject considerably infiltrated, and whose tissues are very humid. (Ibid.) This is a point which can only be determined by the judgment of the physician in individual cases. We recently met with a case precisely such as Laennec describes, and, at the first glance, it struck us and two eminent medical friends as being inflammatory; but a brief inspection proved the reverse. It is necessary, however, to be alive to this source of fallacy. Kreysig, Hodgson, and Bertin and Bouillaud are of opinion that lymph effused by inflammation is the source of fungous or warty vegetations of the valves. Laennec rejects this opinion, and attributes the vegetation to sanguineous concretions which adhere to the internal membrane, and become organized. He does not deny, however, that an inflammatory false membrane may become the nucleus of these concretions. This subject will be more fully considered under the head of vegetations.

Effusions of lymph are, in some instances, the result of chronic inflammations; for they are found in the vicinity of ossifications of arteries and other morbid alterations of a chronic nature. We have seen an ossified common iliac obliterated by a plug of lymph. Hodgson has witnessed nearly the same; and Dr. Goodison found the aorta itself obliterated by lymph, at a part where its whole circumference was converted into a bony cylinder. This lymph must have been secreted gradually; as the force of the aortic circulation would have washed away any soft and copious recent effusion. It is probable that the obliteration of arteries in the neighbourhood of vomicæ and other ulcerations, and of tumours, is also occasioned by chronic inflammation.

Ulceration of the internal membrane.—Ulceration of the internal membrane sometimes takes place from acute inflammation, without any lesion of the subjacent tissues. This, however, is rare; for, in general, the ulceration is a consequence of some previous chronic degeneration of the coats of the vessel, and is, in the first instance, rather a solution of continuity than an ulceration. Such is the case when it is occasioned by the detachment of calcareous incrustations, or by the deposition of atheromatous or other matter underneath the internal membrane. Ulcers from these causes are not uncommon, and though they do not, strictly, come under the head of acute arteritis, they may be conveniently considered in this situation. They vary in size from a mustard-seed to a pea or bean, have more or less thick and ragged edges, and are sometimes so deep as to reach, and even to perforate, the external or cellular tunic. Laennec describes the formation of these ulcers from calcareous incrustations in the following manner: "When a calcareous incrustation," says he, "is detached from the aorta, the species of sinus left by it is filled up by fibrine, which becomes, by decomposition, of the consistence of friable paste, and is often intermixed with phosphate of lime." This paste, when soft and pulpy, has been denominated *melicere*, or *atheroma*. Not unfrequently, the borders of the lesion are reddened for a little distance; and this he attributes to imbibition of blood, (rendered more easy in an altered structure,) rather than to chronic inflammation, which he thinks is not proved either by the presence of pus, or of any symptoms, local or general, that can be referred to it. These lesions, therefore, he regards as being, in the first instance, merely solutions of continuity from an entirely mechanical cause; and not ulcers, occasioned by inflammation. He does not deny, however, that the oldest and most extensive of them sometimes become ulcers; for the internal membrane at the borders of the lesions is slightly tumid and red, and the surface of the fibrous tunic at their base is manifestly altered. But he contends that the inflammatory action which gives them the character of ulcers, is the effect, not the cause, of the solution of continuity. Solutions of continuity occasioned by the detachment of calcareous incrustations, are among the most frequent causes of consecutive false aneurisms.

Small pustules filled with pus sometimes, though rarely, present themselves under the internal membrane of the aorta, and burst into its cavity. It is probable that they form the genuine or primitive ulcers of that vessel,—those which are the most frequent cause of its perforation. They sometimes throw out curdy, and even calcareous matter. Laennec thinks that these pustules are occasioned by inflammation, not of the internal, but of the middle arterial tunic, or of the fine cellular tissue which unites the middle to the internal tunic; and he is of this opinion, because, in inflammation of all membranes, as the peritoneum, the pleura, the mucous membrane lining the bronchia, &c. pus forms on their free, and not on their adherent surface. Therefore, as this secretion is found on the adherent surface of the inner arterial membrane, he infers that the inflammation occasioning the pustule is seated, not in that membrane, but in the subjacent tissues. Pus is scarcely ever found on ulcers of the heart and arteries, because it is washed away as soon as secreted. For the same reason, it is never found on the internal surface of arteries that are inflamed without being ulcerated, though analogy leads us to believe that, under these circumstances, it is secreted.

Ulcerations are extremely rare in the cavities of the heart. We recently met with an instance, originating in a curdy deposition under the lining membrane. We have never seen or heard of a case in which inflammation, when confined to the interior of an artery, terminated in gangrene. Arteries, however, are frequently involved in the sloughing of surrounding parts; in which case the blood generally coagulates in the vessels to a considerable extent above the line of sphacelation, and thus prevents hemorrhages. (Hodgson, p. 17.)

It remains to be noticed that arteritis is sometimes of an erysipelatous nature. We allude to that which follows an injury of an artery, as by a ligature, a gun-shot wound, &c. especially if there be deep-seated disease in the muscles of the part affected. The inflammation, in these cases, sometimes runs along the internal coat of the artery till it reaches the heart. It is a most formidable disease, rapidly producing great irritative fever, an extremely quick pulse, complete collapse, low delirium, and generally death.

CHRONIC ARTERITIS AND THE MORBID ALTERATIONS CONNECTED WITH IT.

Arteries are more subject to chronic than to acute inflammation. The internal membrane, when so affected, is thickened, softened, and of a deep dirty red colour. These appearances are not uniformly diffused, but are more marked in the vicinity of calcareous and other degenerations. Hence some have supposed that these degenerations were the cause of the inflammation. There can be little doubt that they tend in many instances to keep it up; but it is highly probable that the degenerations themselves were originally caused by increased vascular action of a chronic nature. Whether the increased vascular action be in every case, particularly those of calcareous depositions, strictly inflammatory, we shall inquire after bringing the various degenerations under review. Meanwhile it may be remarked that the appearances in arteries presented by chronic inflammation accompanied with morbid depositions, have been well known to authors from a very early period. The ancient physicians ascribed them to acrimonious, syphilitic, and scorbutic humours pervading the system. Some modern writers also, particularly Corvisart, Scarpa, Richerand, and Hodgson, impute them to similar causes, especially to the syphilitic virus, or to the mercury used for its eradication.

MORBID ALTERATIONS IN THE COATS OF ARTERIES, AND ESPECIALLY OF THE AORTA.

The morbid alterations in the interior of the aorta which appear to be of chronic formation, are, steatomatous, fibrous, cartilaginous, and calcareous depositions, with a thickened, fragile, and inelastic condition of the arterial coats. The most simple of these alterations is, a loss of elasticity, generally accompanied with increased density and opacity of the coats of the artery. This state is sufficient of itself to give rise to dilatation, by a process which will be described under the head of dilatation of the aorta.

Before describing the depositions, it may be premised that they originate, not in the internal coat, but either in the middle coat, or in the fine cellular tissue interposed between it and the internal coat; that this coat can sometimes be peeled off from them in a perfect state, even when they are far advanced; and that the productions themselves are more analogous to those of a fibrous than of a serous membrane.

The extent, the form, and the thickness of the productions are infinitely various: sometimes the several species exist separately, but more commonly they are found more or less intermingled in the same artery. The first and most common appearance is that of small, opaque, straw-coloured spots, immediately underneath the lining membrane, with slight inequality and corrugation of the membrane around them. At a more advanced period the depositions form considerable, slightly elevated patches, which, becoming confluent, sometimes overspread the whole surface. Some of these patches have much the appearance and consistence of bees'-wax, or cheese, though in general their cohesions and flexibility are greater. These are usually denominated steatomatous. Others, presenting nearly the same colour, have a fibrous or ligamentous appearance; while others, again, are more translucent, white, and elastic like cartilage or fibro-cartilage. All the depositions described are accompanied with thickening and loss of elasticity of the internal coat, which becomes knotty, wrinkled, and sometimes cracked, scaly, and fimbriated. This, however, is less decidedly the case until earthy depositions have taken place. These generally commence in the midst of a cartilaginous or fibro-cartilaginous patch, though they are sometimes found in detached scales, and sometimes in a soft or pasty form, in the midst of cheesy, curdy, or melicerous matter. When they form incrustations, the shape of these is irregularly flattened; the prominences being towards the exterior rather than the interior of the artery. Their external surface sometimes presents the imprint of the circular fibres of the middle tunic. Their internal surface is sometimes smooth, and evidently covered by the membrane; in other cases it is rough, and the membrane is more or less destroyed. Calcareous depositions occur most frequently in the ascending portion and arch of the aorta, but occasionally they pervade the whole of the vessel, and even almost the whole of the arterial system. We saw a case in the Hôtel Dieu, in which the great arteries from the heart to the ankle were converted into rigid tubes by ossification, which in parts occupied all the coats and the whole circumference of the vessels. *In* another case, at St. George's Hospital, the common iliacs were rigid; and one of them, which was converted into a long cylinder, was obliterated by a plug of dense lymph. The arterial system was elsewhere more or less ossified. Both the patients died with gangrenous sores of the legs.

In the arteries at the base of the brain, calcareous and other degenerations are remarkably frequent, and are a principal cause of apoplectic effusions. It is rare, indeed, to meet with an instance of such effusion, exclusive of those dependent on external violence, in which some disease of these arteries may not be detected; and it may be remarked in passing, that, in most instances, the disease of the artery is connected with hypertrophy of the left ventricle; whence it appears to be referable to over-distension, to which the cerebral arteries are more obnoxious than others, in consequence of their being without the cellular coat, and being ill-supported by the pulpy yielding substance of the brain. We have met with several cases of epilepsy which had no other obvious cause than disease of the cerebral arteries. The arteries below the pelvic divarication of the aorta are more frequently ossified than those of the upper extremities and trunk.

Calcareous concretions differ essentially from natural bone. For though some are formed by the secretion of the earthy phosphate in cartilage, even these have not the peculiar fibrous arrangement of bone. But in by far the greater number of cases, the earthy matter is not secreted in any cartilaginous matrix whatever, but is simply deposited in the form of an irregular homogeneous crust or crystallization, without any determinate arrangement, and without vitality. The proportion of animal matter in these is very small. Mr. Brande found 100 parts to consist of 65.5 of phosphate of lime, and 34.5 of animal matter. In some specimens we have found the quantity of animal matter considerably less.

When ossification is very considerable, it is sometimes attended with induration, inelasticity, and fragility, not only of the internal, but of all the arterial coats; and this state I have seen attended in some cases with thickening, and in others, though less frequently, with extenuation and a horny translucency of the walls of the vessel. The aorta, so affected, generally undergoes dilatation, but very rarely contraction. When the depositions are partial and limited, the internal membrane in the intervals is often perfectly sound. This is especially the case in the ossifications of old people. It is remarkable that, though morbid depositions are so frequent in the aorta, they are extremely rare in the pulmonary artery. Out of upwards of a thousand cases, in which we have examined this vessel, we have never met with calcareous depositions in its coats, and only three or four times with cartilaginous and steatomatous disease and dilatation.

Causes of morbid depositions in the coats of Arteries. — Some authors have considered morbid depositions in the coats of arteries to be, in every case, the various metamorphoses of lymph, effused by inflammation of the acute kind and of such intensity as always to proclaim itself by obvious symptoms, and require antiphlogistic treatment. Others, again, have supposed that many, if not all, of the depositions in question, take place quite independently of inflammation of any kind. As principles of treatment of a decided nature have been founded on each of these conflicting doctrines, it is a matter, not of mere speculation, but of practical importance, to look into the subject, and endeavour to ascertain the truth.

Although it would be difficult to deny that acute inflammation may, in some instances, lay the foundation of morbid depositions in the coats of arteries; yet it is certain that they may and do occur independent of it; as they have been found in individuals who had never manifested any symptoms whatever of inflammation, and who had even constantly enjoyed the most perfect health. Analogical evidence derived from other membranes leads to the belief that chronic inflammation is, in most instances at least, the main agent concerned in the production of these depositions. Thus, for example, the dura mater and the pleura are sometimes not only thickened and indurated, but converted into fibrous, cartilaginous, or bony tissue. We have seen the dura mater converted into a calcareous plate nearly as large as the hand, and overspreading one hemisphere of the brain. The preparation was shown to us by Professor Monro, and is in his museum. Mr. Hammick showed us two preparations, in his museum, of calcareous plates, of about two inches in diameter, on the pleura. Changes of this kind are, by general consent, attributed to chronic inflammation; as they are not only found in conjunction with organized adventitious membranes and other anatomical proofs of that form of inflammation, but are often attended with its symptoms. It is to be presumed, therefore, that corresponding changes taking place within an artery are referable to the same cause. That the morbid depositions in the artery should not be exactly identical with those found in other membranes is to be anticipated on principles of general anatomy; for the effused matter, which is the basis of every accidental production, differs in aspect and nature according to the tissue in which it occurs. Thus, as well remarked by Bertin, the cellular tissue and parenchymatous organs secrete pus, properly so called; thus serous membranes secrete a coagulable matter prone to transform itself into cellular or serous layers; thus the periosteum furnishes another matter, which concretes, hardens, and ossifies; thus the arterial tissue, composed essentially of a fibrous membrane, exhales a liquid which hardens, condenses, and becomes converted into cartilaginous patches, or calcareous scales.

But admitting the agency of chronic inflammation as a cause of morbid alterations in arteries, there is reason to believe, as before stated, that some of them, particularly the calcareous, may take place independently of it; for they are found in most old people; they sometimes occur in various detached points very remote from each other; they often consist of a simple calcareous scale, or an opaque yellow spot, without any morbid state of the surrounding membrane; and such alterations almost always take place without affording the slightest sign, either general or local, of their formation. Now, it is scarcely possible to conceive an inflammation which manifests no symptoms, which is restricted to isolated points often remote from each other, which leaves none of the ordinary vestiges of inflammation in the surrounding membranes, and which is the most frequent at that period of life when phlogistic action is the least prevalent. We are brought, then, to inquire, what is the cause of morbid depositions when they do not appear to be referable to inflammation.

Here it is necessary to proceed with caution, as the ground is purely speculative. Laennec, indeed, thinks it the most simple and philosophical to acknowledge that we know not the derangement of the economy which produces an ossification or a cancer, but that very certainly it is not the same as that which produces pus—as inflammation, (De l'Auscult. vol. ii. p. 684.) If we are not satisfied to remain in this circumspect uncertainty, we can scarcely venture farther, in the actual state of our knowledge, than to suppose that morbid productions are sometimes results of a depraved action of the vessels not identical with or not amounting to inflammation—a doctrine, indeed, which rests on the basis of sound observation, and which has been extensively received, since the accurate researches of the present century have bred a "philosophic doubt" on the tenet of the ancients, that all accidental productions are the effects of inflammation. Admitting a depraved action of the vessels, it is rational to suppose that, like inflammation, it would derive its particular character from the tissue which it affects: hence that the fibrous and fibro-serous tissues of the arteries would degenerate into cartilage, bone, &c.—the changes to which they are most prone under the influence of inflammation. But what is it that calls this depraved action into activity? It appears to us that over-distension of the arteries by the force of the circulation is what, principally at least, produces the effect. To this opinion we are led by the following considerations: that arterial ossifications are the most common when the left ventricle is hypertrophous; that (according to an observation of Boerhaave, related by Morgagni) they are found in stags long and often exercised in running, and not in those which lead a tranquil life in the parks of the great; that diseases of arteries and aneurism are more common, in the proportion of at least seven or eight to one, in men than in women, the life of the former being much more laborious and the circulation more liable to excitement from potation of vinous or spirituous liquors, &c.; that ossifications, &c., occur in those arteries more especially which are most exposed to over-distension, namely, the arch of the aorta, which immediately sustains the whole brunt of the left ventricular contraction, and the arteries of the brain, which, not having the support of a cellular sheath, and being bedded in a soft puffy substance, are weaker than any others; that they are more especially incident to the aged, in whom the arterial and all other tissues sustain a diminution of elasticity and cohesiveness in consequence of the diminished vascularity which characterises old age. Perhaps the same reason, viz., over-distension, may be assigned for the remarkable frequency of the arterial depositions in those who have suffered much from syphilis or mercury; for as these maladies induce a cachectic state which lessens the elasticity of all the tissues, the arterial tissue would, under these circumstances, suffer proportionably more from the distensive pressure of the circulation. To the above catalogue we may perhaps add gout—an affection which is remarkably often attended with arterial ossifications and their frequent concomitant, angina pectoris. For the gouty habit is in general accompanied with a morbid degree of plethora, and consequently with over-tension of the arterial system, leading to ossification.

It may be remarked, finally, that even they who attribute all the morbid alterations in arteries to inflammation, admit the necessity of *specific* inflammations to account for those alterations which are not normal products of ordinary inflammation. Thus Kreysig thinks that calcareous incrustations are only produced by gouty inflammation; and Bouillaud, who employs the word inflammation in perhaps too extended a sense, believes that there must be a *peculiar predisposition* for each effect of the one same cause,—that every variety of deposition must be the result of a different specific inflammatory action.

Symptoms and diagnosis of acute Arteritis.—The diagnosis of arteritis is one of the most difficult in the range of medicine; as the malady presents no signs that are peculiar to itself, and distinguish it from other diseases.

We shall first describe the signs by which some authors have imagined that they could detect acute aortitis, and then subjoin the sources of fallacy to which, according to our experience, those signs are liable. The practitioner, being thus warned against the various causes of deception, will be better able to give their full value to the signs themselves; and he may in this way, we think, make out the diagnosis with some success.

The principal sign of acute aortitis, according to authors, is a pulsation of the aorta much more violent than in the healthy state. A pain and sensation of heat in the region of the aorta, anxiety, and faintishness, are symptoms of a less constant nature, but which, nevertheless, it is important to mark. To these are to be added acceleration of pulse, heat, and dryness of the skin, thirst, anorexia, and all the other concomitants of phlogistic action. The position of the thoracic aorta is such that the strength of its pulse can only be explored in the hollow at the summit of the sternum and above the clavicles. The beating of the ventral aorta may be more easily examined, namely, by applying the hand, or, what is better, the stethoscope, on the abdomen.

Violent pulsation of the aorta from inflammation is often accompanied with a similar pulsation in any or all of the great arteries; the reason of which is, that the inflammation not unfrequently extends to the other arteries, and even to the whole of the arterial system.

With respect to inflammation of the internal membrane of the heart, it is excessively rare in an isolated form, being almost invariably attended either with carditis or pericarditis. Analogy indicates that it ought to be characterized by augmentation of the force and frequency of the action of the heart and arteries, and leads us to expect that when the inflammation reaches and disorganizes the muscular substance, it would render it incapable of contracting with its natural strength and regularity. Observation confirms what analogy leads us to foresee. In fevers, properly so called, which appear to be constantly accompanied with an irritation of the heart, the frequency and force of the pulse are the two principal phenomena that strike our senses; but should the fever assume a typhoid type, and give rise to an irritation of the heart, so profound that the muscular substance is itself attacked, the pulse loses its force and regularity while it augments in frequency, an unexpected death often terminates this always formidable complication. Should the patient recover, the slowness of his convalescence and the frequency of pulse which characterize it, are probably dependent either on an irritable state of the internal membrane left by the inflammation, or on softening of the muscular substance,—a subject to which we shall revert when treating of softening.

Such are the symptoms of acute arteritis assigned by authors. The fallacies to which they are liable are so numerous that many able practitioners formally avow their inability to make the diagnosis. The fallacies arise, 1st, from the inflammatory complications with which arteritis, and more particularly aortitis, is accompanied: 2dly, from affections which, though unattended with arteritis, occasion arterial pulsation.

1. *The inflammatory complications of aortitis.*—Acute aortitis is very rarely known to exist (so far as we can judge from its anatomical vestiges—the only positive criteria) independent either of continued fever, or of inflammation of some of the principal viscera, particularly the lungs, pleura, and pericardium. In these complicated cases the symptoms of aortitis are lost in those of the concomitant malady, which is of itself capable of producing, to a greater or less extent, the same violent arterial pulsation and the same anxiety and faintishness as are considered characteristic of aortitis.

2. *Affections which, though unattended with arteritis, occasion arterial pulsation.*

(*a.*) When the interior of the ascending portion, or arch of the aorta is ossified or cartilaginous, there is generally a preternatural pulsation above the clavicles, and this always takes place when the artery is dilated; for, as the blood permeates the diseased or dilated portions with greater difficulty than others, in consequence of its being reverberated in counter-currents and eddies from prominences in the vessel, those portions sustain, at each contraction of the heart, an increase of the expansive force of the blood, the lateral pressure of which is always augmented in proportion as the direct current is impeded.

(*b.*) Persons of an irritable temperament, especially delicate hysterical females and hypochondriacal males, are subject to morbid arterial pulsation, sometimes confined to the aorta alone, and sometimes universal throughout the system. When it is seated in the descending aorta, the patient complains of "a fluttering" in the epigastrium.

(*c.*) Morbid arterial pulsation is a phenomenon of reaction after loss of blood—a fact to which the attention of the profession has been drawn with great ability by Dr. Marshall Hall, and which we have verified, not only by observations on the human subject, but by extensive experiments on animals, performed in concert with that gentleman. The pulsation not unfrequently supervenes, and subsists for a considerable time, after the free depletions necessary for the cure of acute inflammatory affections, as pleuritis, pericarditis, peripneumony, phrenitis, peritonitis, &c. In these cases it would be a dangerous error to suppose that the pulsation depended upon aortitis.

(*d.*) We have found arterial pulsations to accompany adhesion of the pericardium, especially for the first year or so after the attack of pericarditis which occasioned it. The phenomenon is attributable to the jerking and, as it were, spasmodic manner in which the heart contracts under such circumstances. It may be remarked that there was adhesion of the pericardium in two of the three cases from which more especially Bertin and Bouillaud derive their opinion that aortic pulsation is always a sign of aortitis. (Bertin, Obs. xxvii. xxviii. and xxix.)

(*e.*) Tumours, serous effusions, &c. in contact with the aorta, give it the character of preternatural pulsation, as they transmit its impulse more strongly than the parts which properly environ it. The mode of distinguishing these pulsations is treated of under the diagnosis of aneurisms of the aorta.

From this long catalogue of fallacies it will be apparent that the diagnosis of arteritis is beset with much difficulty. Still, it is not wholly hopeless; for, by a negative process,—by ascertaining that the pulsation is not attributable to any of the causes mentioned,—I believe it is possible to form an opinion which will not be very wide of the truth.

Of *chronic* arteritis, it is sufficient to say, that, though it in all probability deteriorates the general health, it presents no distinctly appreciable signs but those of the structural alterations,—the depositions, dilatations, and valvular obstructions,—to which it gives rise.

Prognosis.—Arteritis is not a dangerous disease by its immediate effects; but it may lay the foundation of disease of the arterial coats and valves of the heart, which may ultimately prove formidable by inducing aneurism of the vessels and disease of the heart. When arteritis is complicated with fevers, or visceral inflammations, the prognosis must be founded on the symptoms of the latter maladies.

Treatment of arteritis.—Arteritis is to be treated on the same general principles as any other inflammation; namely, by bleeding, purgatives, diaphoretics, low diet, cooling diluent drinks, and perfect tranquillity. The latter is absolutely necessary, as any efforts which accelerate the circulation increase the tension, and therefore the irritation, of the arterial system. On the same principle, remedies which calm the circulation, as digitalis, tartrate of antimony, superacetate of lead, are useful auxiliaries when discreetly employed; but they should not supersede the more important remedies above mentioned, nor should they be given at a late period of the disease, when the symptoms, which of themselves become complicated, should be kept as unembarrassed and clear as possible. When mercury is not contra-indicated by a strumous or shattered constitution, its exhibition to the extent of slight but prompt salivation, after the first violence of inflammatory action has been repressed, is attended with excellent effects.

When arteritis is complicated with visceral inflammation or fever, the treatment must be directed to the primary malady.

J. Hope.

[ARTHRITIS. See Gout.]

ARTISANS, Diseases of.—The diseases of artisans must, in every civilized country, be an object of great importance, but in none can it be so important as in Great Britain, so large a proportion of whose inhabitants are engaged in manufactures. In the present article we propose to give a brief account of these diseases, and to accompany it, as far as we can, by that of the attempts which have been made to deprive the various trades of their injurious tendencies.

The arrangement which we shall follow will, with some modifications, be that which was first indicated by Ramazzini, modified by Fourcroy, and again modified by M. Patissier. The groundwork of the arrangement is founded upon the causes of these disorders; and we, first of all, have two classes. The *first* includes the diseases caused by moleculæ, which, mixed with the air in the form of vapour or fine powders, are respired by the workmen, penetrate their organs, and disturb their functions. The *second* class comprehends the diseases caused by excess or defect in the exercise of certain parts of the body. Under the *first* class are comprehended, 1. diseases produced by *mineral* moleculæ; 2. those arising from *animal* moleculæ; 3. those which result from *vegetable* moleculæ; and 4. diseases which are produced by the mechanical action of moleculæ or fine powders, arising from mineral or vegetable substances. The *second* class embraces, 1. diseases arising from the effects of *moisture* and of *temperature*; 2. diseases from *undue or excessive muscular exertion of particular parts or organs*; 3. diseases arising from *sedentary habits.*

Before entering thus upon the effects of peculiar substances and the effect of particular positions, a preliminary inquiry ought to be made into the consequences of labour abstractedly taken. There is unquestionably considerable difficulty attending it; but yet it seems impossible to reject over-confinement alone, or over-exertion alone, as productive of severe maladies. We are accustomed frequently to witness the consequences of overworking that most useful animal, the horse; and, in this respect at least, there is nothing physically different between man and the other mammalia. In the horse, the kind of labour has evidently nothing to do with it, since the same exercise, moderately taken, contributes to the preservation of his health and the improvement of his strength; it is the quantity alone to which the injury is to be referred. The same remark holds equally good of man, but very many circumstances attending his occupations will require to be taken into account. In the first place, the quantity of labour which different individuals can undergo without detriment, will vary much with the original constitution of their bodies and their habits. A man of great natural physical strength, other things being equal, will perform more labour than a man of less powerful make; of two men of equal natural powers, the one, accustomed to continual hard work, will bear more than the other, unaccustomed to such employment; and, in the second place, very much will depend upon the quantity of nutriment which can be obtained. A more striking instance of this could scarcely be adduced, than what occurred to the persons engaged with Captain Franklin in the travels to the North Pole. We find them preserving their strength, and easily enduring the journey to the sea, though called upon perpetually to great bodily exertion; but on their return, having been for some time deprived of sufficient food, the strongest amongst them was scarcely able to carry his gun, and not at all able to steady it, so as to obtain any of that supply which appeared within their reach.

Taking, nevertheless, all these considerations in review, there are, even in Great Britain, many instances of evil effects arising from the long continuance of labour—of that labour, which not only would not be injurious in a moderate degree, but would most probably conduce to the healthy action of the corporeal functions. The majority of these cases take place among children, and chiefly among those occupied in cotton manufactories.

Upon this part of our subject we have fortunately some very strong evidence, and from a source which is perfectly unsuspicious. A few years ago, the injury which, it was natural to suppose, must ensue to young children, from too early overstraining their physical powers, engaged the attention of parliament, and, under the influence of Sir Robert Peel, a variety of manufacturers were examined, together with many of the first medical men of the kingdom. It was scarcely reasonable to expect that the former should have observed, or, if they had observed, that they would readily acknowledge, even to themselves, the ill effects which accrued to their young work-people;

and, accordingly, we find that, for the most part, they utterly denied that any evil had ensued from the confinement or the exertion. We are far from insinuating that, in any instance, the manufacturers who were called stated any thing of which they did not feel themselves convinced; but accustomed as they must be to employ children, and little as they naturally would feel disposed to indulge in an inquiry which must necessarily take up much time, the probability is that they would be in perfect ignorance of the subject. Among them, however, we find Mr. Owen not only acknowledging but remedying, as far as in him lay, the evils which arise from the too early and too long employment of children. We are well aware that the Utopian visions of this gentleman will make many persons receive his testimony with deductions from its value; but when he relates a mere matter of fact, and when this fact is in perfect accordance with the opinions of the most enlightened medical men, we do not feel inclined to detract one iota from its force. In speaking of the children who were engaged in his manufactory at New Lanark, he says, "I very soon discovered, that, although these children were extremely well fed, and clothed, and lodged, looked fresh, and, to a superficial observer, healthy in their countenances, yet their limbs were very generally deformed, their growth was stunted, and, although one of the best schoolmasters on the old plan was engaged to instruct those children, they made a very slow progress even in learning a common alphabet." We are the more inclined to confide in this statement, from having made similar observations ourselves in an asylum for children, in a large manufacturing town. In this instance, the individuals were certainly properly nourished, but they were confined eight or nine hours a day in heading pins and straw-plaiting; but this they did not commence till past seven years of age. Yet, upon an extensive comparison of them with others not so confined, we have no hesitation in saying that their growth was stunted; the buoyancy of infancy, usually so remarkable and engaging, was lost; neither was there that freedom of action in the limbs, which, in children, is generally so conspicuous.

Sir Astley Cooper, who likewise gave his evidence before the committee, states the ill effects of confinement in still stronger terms, if possible, than Mr. Owen; and as he asserts his opinion to be the result of extensive observation, it is particularly deserving of attention. He says, "The result of confinement commonly is not only to stunt the growth, but to produce deformity, and to that point I can answer, from a good deal of experience, that deformity is a common consequence of considerable confinement." It does not appear that any of the other medical men, at least of those who are known to the profession, had had many opportunities of personal observation; but their opinions, so far as they had been able to form any, coincide with those which have already been given. It must, indeed, be admitted that even medical testimony has been adduced to prove that none of these evils are present in cotton factories; but it is not with medical as with common evidence, where, provided there is equal integrity, the most numerous witnesses must be credited. In medicine much more is required; ability, vigilant observation, and great candour; and a single witness, known to possess these qualifications, is to be listened to with much more confidence, even with regard to mere matters of fact, than a whole host of common observers. On this account, therefore, even had Sir Astley Cooper's evidence stood alone, we should have been disposed to believe it rather than that of men who, however respectable they may be in their own little world, are utterly unknown beyond it.

The bad effects of over-exertion, however, are not confined to children, though the intemperance and irregular habits of adults make it much more difficult to ascertain them. Among the poor, the idea of having over-worked themselves is not uncommon; and, necessarily as suspicion attaches to their own evidence, many cases have occurred to us, as we feel assured they must have done to others, in which general exhaustion and debility were readily traced to this source.

Such, therefore, being the consequence of labour, not with regard to the kind, but the degree, it forms a most important subject of inquiry, to what extent an individual may exert his physical strength without deteriorating or retarding the full development of his powers. To enter deeply into this, however, would lead us into digression from our present subject; and we must content ourselves with stating the opinion of the late most eminent physician, Dr. Baillie, and in which he was supported by Drs. Pemberton and Tuthill, Sir Gilbert Blane, Sir Astley Cooper, and Mr. Carlisle. "Seven years old," says Dr. Baillie, "is perhaps the earliest age at which children should be employed in factories; and for the first year they should not be employed more than four or five hours a day; for the two succeeding years six or seven hours a day; afterwards they might be employed ten hours a day; and beyond that, in my opinion, there ought to be no increase of labour." That there are extraordinary instances, in which more than the time here specified is passed in labour, is unquestionable; but these are too few in number to disturb the general accuracy of Dr. Baillie's opinion.

[By the modern factory laws of England, no child under nine years of age is permitted to work at all; and before thirteen, it can only be employed for nine hours a day. The necessities or the cupidity of parents, it would appear, are continually inducing them to misrepresent the ages of their children; and it has, therefore, been found desirable to discover some test, by which the capability of the child may be determined, without a knowledge of its age. A standard of height has been adopted by the legislature for the purpose, but upon grounds, which, physiologically considered, are very erroneous; as the tallest children are often the most weakly. (Carpenter, *Principles of Human Physiology*, Amer. edit. p. 482: Philad. 1843.) According to Mr. Sanders, (*The Teeth a Test of Age*, &c.: Lond. 1842,) the degree of advance of the second dentition may be regarded as a much more correct standard of the degree of general development; and it may be taken as a guide to the age, in the large mass of cases.]

We now proceed to the consideration of the first class which we have indicated above, viz. diseases caused by moleculæ, which, mixed with the air in the form of vapour or fine powders, are respired by the workmen, penetrate their organs, and disturb their functions. The *first* order comprehends the diseases produced by *mineral* moleculæ.

1. *Mercury.*—The gilders of toys and buttons, glass-platers, and the workmen in quicksilver mines, are nearly the only individuals sufficiently exposed to the fumes of this metal to be affected by it; though there is no doubt that wherever any one is long occupied with mercury, the same diseases would occur. One of the most common consequences of exposure to mercurial vapours, is a great increase of sensibility to cold. Dr. Gosse perhaps exaggerates when he says that such workmen are so sensible to the variations of the atmosphere that they may be compared to living barometers; but we have seen several individuals who were immediately alive to very slight diminutions in the temperature of the air. One instance is still before us, which occurred in a young lady, who was salivated by accident several years since, and who is still affected very sensibly by every change in the atmosphere, though she is entirely free from other complaints.

The workmen who employ quicksilver are subject likewise to all those diseases to which latterly the name of pseudo-syphilis has been applied, as ulcerations of the mouth and fauces, eruptions, rheumatic pains in the limbs, and, in short, all the affections which, in former times, were comprehended under the title of cachexia. Terrible as these disorders are, there is nothing peculiar in them consequent upon the manner in which they arise; they exhibit the same phenomena, are equally distressing, and equally obstinate, as when proceeding from the internal administration of mercury for the cure of lues.

The disease which seems more peculiar to the workmen who employ this metal, is that to which the name of mercurial palsy has been assigned; and it arises very seldom, if ever, from the exhibition of mercury as a medicine. The attack of this disease is sometimes sudden; more frequently, however, its approaches are very gradual: at first the workman has less control than usual over his arms; then they are subject to slight convulsive snatches; they become agitated, and at length are in a continual state of tremor. The tremor continues to increase in intensity, if the individual still persist in his employment, and spreads from the arms, which it commonly first attacks, to the legs, and finally to the whole body. The patient is unable to execute perfectly any of the functions which require a certain muscular power, such as locomotion, mastication, any labour of hands, &c. To these succeed sometimes pains in the bowels, restlessness, delirium, &c., with great derangement of the general health. After a time, the latter appears to become more settled, and the patient will often live for twenty years, utterly unable to make any useful exertion from the tremor, though in other respects tolerably well. The following account of an instance of this disease, which occurred in a man of sixty-two years of age, and with whom it had endured for twenty-five years, will illustrate it much better than any more general description.

At the time we saw him, all the voluntary muscles were violently agitated, so that every attempt to speak was interrupted by the spasmodic contractions of the jaws and tongue. His head was in a continual see-saw; he could not hold any thing in his hands, and seemed to have no power whatever over them. Any attempt to obtain control over his muscles invariably rendered the convulsions more violent. Mental agitation increased them. His teeth had been lost many years, but had fallen out without being decayed; his appetite was good, and his sleep sound. His evacuations were voluntary.

The disease in this individual had commenced after gilding one year, with a shaking in one knee, whence it had spread to the rest of the body. He continued to work, however, for seven years, but during that time was frequently obliged to take a glass of rum to keep his hands steady, and he always found his tremors less after taking more ale or spirits than usual; but when their immediate effect was gone off, the complaint was always much more aggravated.

It is generally supposed that these tremors never ensue after the medical administration of mercury, and we believe that mercurial palsy very seldom does occur under such circumstances. This is, however, perhaps to be attributed to an insufficient quantity being taken, or the medicine being suspended after some time. It is certainly no unusual occurrence to find patients, who have been subjected to mercurial courses, exceedingly sensitive, and we once saw the tremor established in a child, to whom a considerable quantity of calomel had been given for incipient symptoms of hydrocephalus.

Long as the origin of the mercurial palsy has been known, we are yet unacquainted with any treatment which is capable of removing it. The French prescribe, as usual, their tisans, but without much effect. In recent cases, the tremor vanishes spontaneously, provided the patient ceases to be exposed to the mercurial vapour. Dr. Lettsom thought sulphur was a specific against it; De Haen, according to Dr. Bateman, placed much confidence in electricity; and Mr. Pearson says, "that a free exposure to the open air during a dry state of the atmosphere, whether hot or cold, is, on the whole, the most effectual mode of depurating the habit from a mercurial impregnation." The Cavalier Sementini, in the eleventh volume of the Giornale de Fisica, has given five instances of the successful treatment of this disease by the nitrate of silver. He began with the eighth of a grain; and by the time three grains a day were given, the good effects were manifest, and in twenty days more the man was perfectly cured. We have never yet tried the nitrate of silver, but every other plan has appeared to us entirely useless; and we are inclined to believe, that after obviating the effects of constipation, or opposing any other symptom that is prominent, complete abstraction from the mercurial vapour is alone serviceable. In time the effects in recent cases wear off; but when an individual has once been seized, he is very liable to a relapse upon exposure to the original cause, and hence his former employment ought not to be resumed.

Various plans have been suggested to obviate the ill consequences attendant upon the employment of mercury, and so far as regards button-gilding, the success has been tolerably complete; at least, if it is not so, it is to be attributed to the inaccuracy of the apparatus and the negligence of the workmen, rather than to any thing wrong in the principle of the operation. In order to explain this, it is necessary to take some notice of the process of gilding. This may vary a little in the different workshops as to the minutiæ of the art, but not in any material respect. Our account is taken from the inspection of two extensive manufactories, one of buttons, and the other of gilt toys.

There are two parts of the process which are attended with danger from mercury, but in very different degrees. The first and least injurious, and perhaps not at all injurious if the workmen are clean in their habits, is the application of the amalgam to the metal. This, which consists of gold and quicksilver, is thrown into a small quantity of solution of mercury in nitric acid in button-gilding, and the buttons are stirred in it; in toy-gilding, the amalgam is generally diffused with a brush. As little, if any, of the quicksilver is vaporized during this process, the principal danger arises from the workmen unnecessarily touching the materials with the naked hand, and not exerting sufficient care to make thorough ablutions before taking their meals.

The next process, which consists in driving off the mercury by heat, is highly dangerous, in the old and common method of gilding. This, which is technically named cap-and-pan gilding, is effected over an open stove fire. The articles are placed in a common frying-pan, and every now and then are taken off and shaken in an old hat. During the whole of this time the mercury is very imperfectly carried up the chimney, and, consequently, its fumes reach the workmen, more especially when the materials are in the hat. This plan is now followed in the gilding of toys; but in button-gilding an apparatus has for some time been employed. to which, if well executed, it seems scarcely possible to add any thing. For this purpose, the buttons are enclosed in an open wire cylinder, which is then introduced into another cylinder formed of iron, communicating with a flue, and placed over a stove. At the entrance are folding doors, with a small opening for the iron rod, which passes through the wire cylinder, for it to rest upon, and the wire cylinder has likewise a support at the opposite end, so that it may be revolved within the iron cylinder by the workmen. The latter commonly stand several feet distant from the stove. When this apparatus is properly made, the draught of air is very great, and it seems scarcely possible for those employed to be at all subjected to the fumes of the mercury; and we believe that it very rarely happens that the workmen become disordered where it is used. It is somewhat unfortunate that the same plan cannot be employed in toy-gilding, or that it is not; for we confess we are not ourselves aware of any really well founded objection to it. Even, however, when the old method is employed, there is great reason to believe that the serious evils attending it, arise for the most part from the carelessness of the gilders themselves. As some corroboration of this opinion, we may state that we have just seen a gilder who has now been in the business for thirty-eight years, and the greatest part of this period he worked at a common stove, but without experiencing a single inconvenience during the whole time. His appearance was remarkably cleanly; and being an intelligent man, we asked him the principal source of the mercurial tremors, and he answered, the careless and uncleanly habits of those employed. He himself had always been accustomed to frequent ablutions, and had never eaten without this precaution. This instance does not, of course, prove that the evil effects of the mercurial vapours can always be avoided by these means, but the observation of most manufacturers might be citen in proof of the workmen usually neglecting them.

It would not, perhaps, be quite fair to omit here the notice of M. d'Arcet's « Fourneau d'Appel," especially as the Académie Royale des Sciences de l'Institut de France awarded the prize of 3000 francs, left by M. Ravrio, for the invention; although, with due deference to such enlightened judges, we are far from thinking that it will, in any great degree, be efficacious in lessening the evil. The principle consists in increasing the draught of the stove chimney, by rarefying the air at a certain distance above the fire. That we may not ourselves misrepresent the apparatus, we copy the following account from M. Patissier. « Il imagina de construire un fourneau dit *d'Appel*, dont le tuyau s'ouvre à une distance calculée dans la cheminée, et dont la chaleur, dilatant l'air de celle-ci, augmente son *tirage*. En même temps on place à une fenêtre un vasistas; il s'établit alors dans l'attelier un courant ascenscionel, qui entraîne avec rapidité dans la cheminée les vapeurs et les gas nuisibles." There are two most powerful obstacles to the efficacy of this plan; the first is, that, in the common method of driving off the mercury, which alone seems to be known in France, the articles are frequently removed from the draught for the purpose of shaking them, and this when the metal is still in a state of vapour; and the other is, the additional expense which it entails; which, in a country not subjected to the perpetual interference of a police in its private affairs, would be a great obstacle to its adoption, and go far to annihilate the trade of those who were compelled to adopt it, while others were not under a similar compulsion. How far in France the recondensation of the mercury may compensate for the additional expense, we do not know; but in England, where this has been long effected, it could, of course, be no recommendation. Upon the whole, we believe the cylinder to be fully adequate to its intention, and we are convinced that nothing but prejudice prevents its application, under such modifications as might be found necessary, to every species of gilding in which mercury is employed.

The next metal, of which we shall consider the injurious effects, is lead, which, both from the serious diseases it induces, and its extensive employment, may be viewed as the next in importance to mercury.

2. *Lead.* — The workmen employed in lead mines, those who purify it, cast it, in short all who use its various preparations in the arts, are ex-

posed to the deleterious effects of this metal. Sir John Sinclair asserts that one labourer in three dies annually in the manufactories of the carbonate or common white lead. Lead is particularly dangerous in a state of fusion; its particles penetrate into our organs through the pulmonary and alimentary passages, and by the skin. The workmen are consequently subject to colic, and to a particular species of palsy.

The class of people most subject to these complaints are plumbers and glaziers, painters in oil and water colours, type-founders, and colour-grinders. But though these are the principal persons liable to be injured by lead, we frequently find the peculiar diseases among other classes. Excepting, however, in particular idiosyncrasies, the same remark may be applied here as in the case of mercury, viz. that very much depends upon the cleanliness of the workmen. Dr. Fothergill has given a curious illustration of this in a young artist, who was in the habit of sucking her pencils; and, on the authority of Dr. Heberden, he attributes many of the diseases of children to their being permitted to play with painted toys, which they are constantly putting to their lips. Sir George Baker has recognised lead as the cause of the Devonshire colic; and it has been remarked that the use of leaden pipes for the conveyance of water employed in cooking, is not unoften the source of the same complaints. Particular individuals are much sooner affected than others by this metal, as happens likewise with mercury. Thus, to reside in a newly-painted house will immediately excite, in some persons, the colica pictonum, as it has been termed, or dry belly-ach.

[The workers in white lead appear to be most subject to the disease; and the more volatile the lead is rendered, the more readily does it appear to affect the system. Painting the "dead white," or "statuary white," according to Dr. Stokes, (*Lectures on the Theory and Practice of Physic*, 1st Amer. edit. p. 180,) is the most deleterious form of using lead, to the house-painter. In this case, white lead is used, combined with a large proportion of oil of turpentine; and the outer air is excluded as much as possible, so that the air of the apartment becomes strongly impregnated with the lead. It would seem, that the deleterious effects of lead are chiefly produced by the carbonate.]

The following account we copy from Dr. Pemberton, as being more concise than that of M. Patissier, not to say also more correct. "The complaint (*colica pictonum*) is known by a violent and constant pain about the navel, with a retraction of the integuments towards the spine, by an obstinate costiveness, and by a frequent but ineffectual desire to evacuate the contents of the bowels. There is sometimes, though not always, considerable retching; and when vomiting takes place in this disease, what is thrown up is usually of a green colour. This is a state of the complaint which will last for several days, during which time, however, the pain will vary somewhat in degree, though never entirely cease. A mild kind of delirium, nay, a perfect mania, will sometimes take place, and continue the whole time the bowels are constipated. These, however, are not very common circumstances; and when they do occur, they seem to have no influence in retarding the patient's recovery. In this disorder, the greatest relief from pain is experienced by keeping the trunk bent upon the knees. The pulse is usually not more than a hundred in a minute. The tongue has a natural appearance, and is moist; and there is scarcely any fever. The situation of the pain round the navel, the retraction of the belly, the costiveness, the absence of fever, the pulse, and the preference given to a bent position of the body, will distinguish this from every other disease of the abdomen." The treatment of colica pictonum consists in evacuating the bowels, for which purpose castor-oil is commonly chosen, assuaging the pain, if necessary, with opium; and in most cases this practice will succeed. (See Colic.)

When the colic has endured for some time, and occasionally when it has not been present, there results a peculiar species of paralysis, which affects the superior extremities only — very rarely the inferior. For the best description of the limb in this state, we are indebted to Dr. Pemberton, as likewise for a method of remedying it.

The wrist, says Dr. Pemberton, in many cases of this paralysis, becomes remarkably flaccid and loose, as if the weight of the hand had stretched the capsular ligament. The adductor muscles of the thumb gradually waste away. This is supposed to arise from a more rapid absorption of the part taking place, in consequence of pressure from the handle used in painting; but the wasting being observed equally in each hand would rather militate against such an opinion. Dr. P. states that he had long thought some assistance of a mechanical nature might be applied likewise for the purpose of relieving the topical paralysis, by placing the muscles in such a state as that they might again be enabled to resume their lost action. Having formed this idea, he proceeded to put it to the test of experiment upon a man who was perfectly paralytic in both wrists. For this purpose a splint was framed; and for the manner in which it ought to be applied, we must refer to Dr. Pemberton's book. The result, however, was most satisfactory. In nine weeks the extensor muscles of the right hand, to which the support had been given, appeared to have entirely regained their natural strength; while the left, which had not been splinted, remained perfectly paralytic. The splint was now applied to the left hand, and in seven weeks the power of the extensor muscles of that hand also was perfectly restored.

It is not to be expected that even this plan will be uniformly successful; but we have no hesitation in saying that it has made a disease for the most part manageable, which was formerly peculiarly obstinate and hopeless.

With respect to preventives, we have very little to say; perhaps nearly every thing may be included in one word, cleanliness, frequent ablution, and, as far as possible, frequent change of linen.

[Since proper precautions have been taken in some of the large smelting establishments of Great Britain, it has been found, that much fewer cases of lead paralysis and lead colic have occurred than formerly. These precautions consist in compelling the workmen, before going to their meals, to change their clothes, and to carefully wash their hands with the aid of a nail-brush, so as to remove every particle of the metal, and thus prevent it from entering the digestive organs along with the food. It is affirmed, too, by M. Bréchot, (*Annales d'Hygiène*, t. xii.) that in the white lead manufactories, the superintendents, who do not handle the lead, escape the disease. (Guérard, *Dict. de Méd.*, 2de édit. xxvi. 105: Paris, 1842.) Still, lead cachexia occurs at times, notwithstanding every precaution; and there is great reason to believe, that the channel, by which the poison is often received into the system, is the air passages.

Recently, sulphuric acid lemonade has been largely employed as a preventive of lead cachexia, in the laboratories of Paris. It has likewise been extensively used by Mr. Benson, the managing director of the British white lead works at Birmingham, in the form of sulphuric beer, and with great success. It acts, he conceives, by converting the poisonous carbonate into the innocuous sulphate of lead. (*Lond. Lancet*, Dec. 17, 1842, p. 435; and Dunglison's *Practice of Medicine*, 2d edit. p. 170: Philad. 1844.]

3. *Copper.*—Extensively as this metal is employed in the manufactories of this country, and though we have long been acquainted with one of the greatest manufacturing towns in Britain, we have not had many opportunities of seeing any complaints among the workmen which could be unequivocally referred to it. M. Patissier says that they become prematurely old, and are meagre and unhealthy in their aspect. To a certain degree this is true, but we believe it is to be referred partly to their confinement, though chiefly to their intemperance. It does occasionally happen that they are attacked with colic, but the number is comparatively small. The disorders of the chest, to which the filers of copper are subjected, are not, we believe, owing to the quality of the metal, but merely to mechanical irritation, and are common to a considerable class of workmen who make no use of copper. The brass-founders frequently become asthmatic; but does not this arise from the vaporization of the zinc or speltre, which they consequently inhale? We suspect it does.

4. *Arsenic* and *antimony* are not so extensively used as to give rise to any disorder, though they are employed but in comparatively minute quantities in a great variety of the arts. Tin, though highly noxious when oxidated, as proved by Orfila, has no effect in its metallic state, and we have never seen any tinmen whose complaints could be traced to their work.

5. The manufacturers of *mineral acids*, which all emit very acrid vapours, are liable, without care, to be asphyxiated, and to severe pneumonic affections, from respiring these vapours. By operating, however, nearly in the open air, and taking merely common precautions, every ill effect from these sources may for the most part be obviated.

The dippers in brass-foundries and gilding manufactories, that is, those who prepare the articles for the gilding, by cleaning them in aquafortis, are liable to the same diseases, without due caution. Formerly, indeed, they frequently fell victims to their occupations; but this process having latterly been conducted, for the most part at least, in the open air, the danger has much diminished. The impunity with which the labourers may work is, however, manifestly dependent upon their own conduct.

We scarcely know whether the accidents to which those who use the mineral acids are subjected ought to be mentioned here, as, with a very slight degree of prudence, they may be entirely avoided.

The *second* order in the first class comprehends the effects of animal moleculæ, during their decomposition, and upon few subjects have more erroneous views been entertained.

The nightmen of Paris, who are employed to empty the immense *fosses d'aisance* of that metropolis, have long been acquainted with the dangers arising from the evolution of the gases. These have been divided into two kinds, *la mitte* and *le plomb*. The *mitte* is caused by ammoniacal vapours. The *plomb* is commonly formed by the sulphuretted hydrogen and hydro-sulphuretted ammoniacal gases; at other times by azote.

La mitte is announced by a sharp odour, which occasions a smarting in the eyes; very soon, the globe of the eye and the pupils become red; at the same time there is an uncomfortable feeling about the nose, discharge, and pain, which, beginning in the orbit, extends to the forehead. To this state a blindness is often added, which endures for one or two days. The patients then experience severe pains, and are unable to support the light; they become restless, and receive no relief till tears flow. If the ophthalmia is slight, it is speedily removed by shading the eyes and exposing them to the open air; if it is intense, the nightmen are accustomed to wash their eyes with cold water, to apply compresses upon the pupils wrung in the same liquid, and to remain in bed in a dark chamber.

Dupuytren and Barruel have observed that *le plomb* produces two distinct affections—the one, the most common and the most terrible, caused by the sulphuretted hydrogen and hydro-sulphuretted ammoniacal gases, is accompanied by convulsions; the other, true asphyxia, from the want of respirable air, is caused by azotic gas, and is characterised by stupor.

The evils arising from the latter gas can only be removed by a free circulation of air, or perhaps, if it were possible, by adding a quantity of oxygen gas. But with regard to the former, the discovery of M. Labarraque in the disinfecting powers of the chloruret of lime and soda, has removed every danger, excepting that which may arise from complete negligence. The mode of employing these substances is by pouring them in solution upon the reservoirs or privies in which the matter evolving the gases is contained. An easier mode, and considering the cheapness of the chloruret of lime, one which will more commonly be followed, is to throw the chloruret in powder into the apartment; and, from experience, we know this to be efficient. We refer the reader, however, for a more extended account of the manner in which these chlorurets should be employed, to Mr. Alcock's essay on this subject, which contains both the fullest and the best statement that has yet been made.

It will readily be perceived that the animal effluvia to which the class of workmen just alluded to are exposed, differ much from every other in the more complete decomposition which the matter has undergone, and the greater accumulation of the resulting gases. Butchers, chandlers, &c., respire these gases much more diluted with air, and appear not to be afflicted by any diseases in consequence of them. We are much disposed to believe that the disagreeable odour of the workshops has been the principal reason of their reputation for unhealthiness: this opinion is confirmed by the testimony of Dr. Bancroft, who has collected many facts in corroboration of it. Besides others, he mentions the establishment of a manufactory of adipocire at Conham, near Bristol, which was not in the slightest degree injurious to the neighbourhood, though the smell was most offensive. To these he added his own experience at Rosetta, where he was daily exposed to the effluvium of putrid bodies, and felt no inconvenience; and a communication from Mr. Lawrence, in which that gentleman says that his experience, as demonstrator at St. Bartholomew's Hospital, was strongly corroborative of the opinion that putrid animal effluvia are not usually detrimental to health.

That animal effluvia are not, in this diluted state, productive of fever, we may mention another proof which is within our own knowledge, and which we know would be confirmed by all the medical men acquainted with the spot. In one part of the populous town of Birmingham, many slaughtering-houses were congregated; and yet, if any situation in the town could be mentioned in which the fewest cases of fever have occurred, it is in their neighbourhood. M. Patissier bears his testimony to catgut-makers not being liable to putrid and malignant fevers, and gives what he believes the explanation of it. "S'ils ne sont pas sujets aux fièvres putrides et malignes, c'est qu'ils travaillent dans des lieux ouverts, où l'air circule librement." We believe, that the pallid countenance, languid appearance, and swelled legs, are neither peculiar to catgut-makers, nor the consequence of their employment; although this author intimates a connexion between these circumstances and the occupation.

[It has been supposed that putrid animal exhalations are a common source of fever — intermittent, remittent, and continued — yet it would not seem that disease of any kind is often produced from this cause. It may, indeed, be affirmed, as the writer has done elsewhere, from numerous observations, (Dunglison's *Elements of Hygiène*, p. 108: Philad. 1835,) that in the vicinity of the workshops of the "knackers,"—whose occupation it is, in the large cities of Europe, to convert the dead horse to useful purposes, cats' and dogs' meat, bones for the distillation of hartshorn, &c.— although the atmosphere is intolerably fetid to the casual visiter, neither the workmen nor the families around are liable to malarious, or to any disorder, which can be fairly referred to that cause; that in the year 1828, a committee was appointed in Paris, to inquire into the circumstances connected with the operations of the knackers; and every one examined by the committee agreed that they were most offensive and disgusting, but no one that they were unwholesome; nay, it was even inferred, that they were conducive to health, as all the men, women, and children, concerned in the works, had unvarying health, were remarkably well in appearance, and strong in body, the workmen commonly attaining old age, and being generally free from the infirmities that accompany it; and when an epidemic fever was in full force, not one of the workmen in the establishment of Montfaucon was affected by it; that, as already remarked, the gut spinner, whose occupations prior to the discovery by M. Labarraque of the disinfecting power of the chlorinated preparations, were most offensive, owing to the putridity of the macerated intestines, enjoyed remarkable health; and lastly, that although the tainted air of the dissecting room is breathed month after month, and for many months, by hundreds of students in different parts of the globe, no epidemic fever or special disease is generated.

All these affirmations have been since confirmed by a hygienist of distinction, (Parent Duchatelet, *Hygiène publique*, Paris, 1836.) In the first place, as regards the shops of the knackers, or *chantiers d'équarrissage*, the filth and stench of whose operations are stated to be horribly offensive, M. Parent describes the establishment of Montfaucon, to which allusion has been made, as immense, the number of horses taken to it, either dead or to be killed, being twelve or thirteen thousand annually. The men are described as enjoying the most flourishing health, the women as most fruitful, and the children as pictures of healthful energy. Of the health of the manufacturers, he speaks in equally strong terms; and he adds, that the workmen in the *chantiers* were remarkably exempt from disease during the prevalence of cholera in Paris. There were fewer fever patients admitted into the Hôpital Saint Louis, which is situate in the district of the *chantiers*, than into any other hospital of the metropolis.

As respects the dissecting rooms, a wide field is afforded in Paris for testing whether they be unwholesome to the students and attendants, and to the inhabitants in the vicinity. M. Parent unhesitatingly expresses his conviction that there is no ground for the belief that the dissecting rooms are *foyers* of morbid emanations. In support of this opinion, he adduces numerous facts, and the decided opinions of Lallemand, Desault, Dubois, Dupuytren, Boyer, and many others; and as regards the effect of the dissecting room on the health of students and persons attached to and employed in them, his testimony is no less unequivocal. He states, and brings forward the testimony of Messrs. Andral, Lawrence, and others in confirmation, that there is no disease whatever to which they are liable from the cadaveric emanations; that gastro-enteritis, meningitis, and typhoid fevers are very frequent, according to M. Andral, among the students during their first year's residence in Paris; but these diseases depend so little upon the mere circumstance of dissecting and remaining in the dissecting rooms, that they are more common amongst those who have not begun to dissect. Desault was in the habit of saying that he firmly believed the air of the dissecting rooms had saved him from attacks of epidemic and other diseases, of which those hospital physicians and surgeons, who seldom or never dissected, appeared to be much more susceptible than he. (*American Medical Intelligencer*, for 1838, p. 162.)]

But though observation appears to warrant the conclusion that butchers are not subject to fevers, nor to any other disorder which can be properly referred to *putrid* effluvia, there seems some doubt whether they do not too freely absorb nutritive particles, as they are particularly liable to the diseases arising from plethora, more especially determinations of blood to the head. The principal circumstance adduced as giving some probability to this notion, is, that cooks, whose appetites are proverbially bad, evince the same symptoms, and frequently fall victims to the same maladies. We are inclined to believe, however, that some errors exist in both cases. From the facility with which butchers can obtain animal food, they usually much indulge in it, and many have acknowledged to us that they are in the habit of eating it three times a day. The business of a cook, likewise, compels him to be perpetually tasting the various dishes which he is composing, and it is impossible to say how much is in this manner consumed; at any rate, the food is subjected to the stomach in the mode most favourable to digestion, and its nearly total conversion to the nutrition of the body.

Butchers evidently enjoy immunity from consumption. M. Patissier says, "On a remarqué qu'ils meurent rarement de le phthisie pulmonaire." Dr. Withering has stated, in a letter to Dr. Beddoes, which was published by the latter in 1793, that butchers and the makers of catgut are exempt from consumption. To these classes Dr. Beddoes has added, from information otherwise obtained, soap-boilers, the fishermen and the fishwives who live in the neighbourhood of Edinburgh. From our own experience in a dispensary of considerable extent, we believe that these remarks are correct; chiefly, however, with respect to tubercular consumption. From those affections of the bronchial tubes which were formerly confounded with phthisis, we do not think they are equally free.

We shall dismiss, with a very few remarks, the remaining orders of this class. They refer chiefly to the diseases incident to medical men, and to those persons who are employed in attendance on the sick. It is generally admitted that in few instances have the disorders to which such individuals are subjected been accurately traced to their employment, excepting those which have evidently their origin in contagion or infection. With respect to anatomists, their diseases are chiefly the results of accident, and diarrhœa occurs in those who are unaccustomed to dissection: as to the adage of physicians, "aliis inservendo consumuntur, aliis medendo moriuntur," we suspect that there are many young physicians waiting for the exit of their *aged* brethren, who would be able to contradict it.

With regard to the operation of the *third* order of the first class, viz. *vegetable moleculæ*, we shall find that some of them affect the system mechanically only, that is, by producing local irritation, which, however, is not influenced by the specific properties of the impinging particles. Others, on the contrary, act by virtue of certain peculiar qualities, and from which peculiar disorders arise, which no other substances have the power of exciting. These circumstances are equally true of mineral substances employed in the arts; but we thought it better to delay considering the action of mineral particles as mechanical irritants, till we could notice, at the same time, the effect of vegetable particles, especially as, in this respect, they differ little, if at all, from each other.

We shall first notice the maladies of those workmen which arise from the quality of the vegetable substance upon which they operate. Few vegetable substances employed in the arts appear to act chemically, if we may so express ourselves, upon the animal system; perhaps the only undoubted instance is snuff. This, however, acts mechanically also, by affecting the air-passages. Its peculiar property induces headach, vertigo, nausea, and perpetual sneezing. [Parent Duchatelet (*Annales d'Hygiène*, &c. p. 1,) believes, that the manufacturers of snuff suffer slight inconvenience from the reduction of the tobacco to powder (*la demolition des masses*), but not in any other manner.]

The bakers' and grocers' itch appear instances of local diseases arising from the peculiar quality of dough, sugar, &c.; but we are not sufficiently acquainted with their origin to speak decisively on this point.

Wine-pressers, brewers, and persons who expose themselves incautiously to fermenting liquors, become sometimes completely asphyxiated by imprudent exposure to the evolving gases. These, however, are rare occurrences. There may be other trades in which vegetable substances induce disorder by virtue of their peculiar properties, but we are convinced that they are neither numerous nor important.

The diseases which are produced by the mechanical irritation of moleculæ or fine powders, are, unfortunately, numerous. The artisans who suffer from this cause, are sawyers, millers, starch-makers, flax-dressers, weavers, wool-carders, feather-dressers, horn and pearl-makers; needle, edge-tool, and gun-barrel grinders; iron and brass filers, with many others. These are the principal labourers included in this order, but they are affected by their occupation in very various degrees. That some owe their complaints, and too frequently their deaths, to their employments, there is not the slightest question; and of those, sawyers and millers, iron and brass filers, suffer the least. Then come horn and pearl button-makers; and, among the grinders, it would be difficult to say which are the most afflicted. They are universally short-lived.

The diseases to which these workmen are subjected are entirely such as affect the air-passages; indeed, we might say *the* disease, there being scarcely any other than that, to which the accuracy of modern pathologists has given the name of chronic bronchitis. It is known among the different grinders under various applications, as "pointers' cough," "grinders' rot," &c. There is nothing peculiar in the symptoms or progress of the complaint, when it has once commenced; but knowing the cause, we feel somewhat surprised that it does not attack them sooner, or that it should attack them at all. It is true that few of these mechanics live beyond thirty or five-and-thirty years of age; but till the last of their lives, they are seldom inconvenienced in any material degree. This, at least, is correct of the grinders;

but in the horn and pearl button-makers it frequently affects them early, endures for many years, and, finally, assumes rather the character of asthma than of consumption. All these workmen have frequent recurrence to emetics, and it is very questionable if a better practice could be advised. We have ourselves had repeated opportunities of observing their efficacy, and we make a constant practice of prescribing one whenever an individual, affected by his trade, presents himself to us. The tartar emetic ointment, also, has appeared of great service, when used to the extent recommended by Dr. Jenner; but when only applied for a few days, we have never perceived the slightest benefit to be derived from it. Upon the whole, however, the treatment varies nothing from that which the disease requires when excited by other causes.

Some of these workmen are likewise subject to inflamed eyes, from the particles impinging the conjunctiva; but these cases are not so numerous as might have been expected.

It is gratifying to be able to state that human ingenuity seems at length to have invented an arrangement which, under some modifications, may remedy the evils of these most injurious occupations. The liability of the needle-pointers to consumption was remarked by Dr. Johnstone many years ago, and he proposed a muzzle of damp crape to arrest the particles; Dr. Gosse, a sponge; and M. d'Arcet, his "fourneau d'appel." Whether any or all of these would be effectual, we have no means of ascertaining, for the workmen would never apply the former constantly, and the latter has never been tried in this country at all. To Mr. Abrahams, of Sheffield, however, we owe an invention, which it appears to us can only fail of success from inaccuracy in its arrangement, or negligence in employing it. For the particulars of this invention, we refer our readers to the forty-second volume of the Repertory, and shall here only extract some of the testimony in its favour from a vice-president of the Society for the Encouragement of Arts, and some of the grinders themselves. "I have no hesitation," this gentleman says, "in stating my opinion, that, whether considered as a novel and ingenious apparatus of the mysterious power of the magnet, or with reference to the more important object of alleviating one of the evils incident to some of our manufacturing processes, and thus rendering them consistent with the paramount claims of humanity, this invention ranks as high as any that has ever been submitted to the Society." Messrs. Cocker & Son, of Hathersage, observe that "the pointer who has most frequently tried your magnets, states that, with the use of them and the damp-bag which he has suspended over the stone, he had not more dust, &c. floating about him in a whole day, than he used to have in a quarter of an hour."

This invention appears to us the more valuable, as one part of it may be applied to pearl button-turning, and several other processes, with very little difficulty, and with great probability of alleviating, if not removing, the evil attendant upon such manufactures.

Before leaving this subject altogether, we cannot omit to notice an invention by Mr. Jones, for gun-barrel grinding, in which no dust arose, and which, being effectuated by a machine, we should have conceived would have superseded entirely the present mode of grinding. Why it did not succeed with the inventor in this country we cannot tell, unless it where "from that callous indifference of the grinders to the fate which awaits them, that their apprehensions are said to have been excited, lest Mr. Abraham's inventions should be successful enough to affect their wages." The consequence, however, has been, that the Emperor of Russia, who saw the apparatus when in England, induced Mr. Jones to settle in his dominions; and, unless we are much misinformed, the plan alluded to is there in full operation.

A local disease, which is confined to a particular class of workmen, may be noticed in this place, viz. chimney-sweepers' cancer. Formerly it was supposed to arise from the qualities of the soot; but Dr. Gosse says, "the climbing-boys in Vienna, I have been told, placed in different circumstances, and not exposed to the soot of coal, present a similar disease." Of the real origin of this complaint, therefore, we must be considered ignorant; but that it is almost peculiar to chimney-sweepers, seems well ascertained. "It always makes its first appearance in the inferior part of the scrotum, where it produces a superficial, painful, ragged, ill-looking sore, with hard and rising edges: the trade call it the soot-wart: in no great length of time it pervades the skin, dartos, and membranes of the scrotum, and seizes the testicle, which it enlarges, hardens, and renders truly and thoroughly distempered; from whence it makes its way up the spermatic process into the abdomen, most frequently indurating and spoiling the inguinal glands; when arrived within the abdomen, it affects some of the viscera, and then very soon becomes painfully destructive." Such is the description given of this frightful disease by that excellent surgeon, Mr. Pott. Fortunately it is but rare; when, however, it has commenced, there is but one remedy, and that is "the immediate removal of the part; I mean," says the same author, "that part of the scrotum where the sore is; for if it be suffered to remain until the virus has seized the testicle, it is generally too late even for castration." Cleanliness might, perhaps, even in this case, prevent the attack; but in an occupation in which cleanliness is almost impossible, the occurrence of a disorder of such virulence ought to form a strong motive for its discontinuance. The frequency of accidents, and the barbarity of master chimney-sweepers, have, we believe, very much contributed to the disuse of boys, and the employment of machinery; and heartily should we congratulate ourselves if any thing we could say should further so desirable an end as its entire adoption, and the consequent release of a number of poor objects from wretchedness and disease.

We shall now proceed to the consideration of the *second* class; and, first, of the diseases arising from the effects of *moisture* and *temperature*.

We very much question whether any disease whatever can be traced to moisture only, we mean to moisture unconnected with its effects upon the temperature of the body. Some proof of this seems to be afforded in the custom of Highlanders of dipping their plaids in water before sleeping in them. A more striking circumstance, however, is that of the shipwreck related by Dr. Currie, where the mariners who died had been only occasionally washed by the surge, while the survivors were always immersed in it. M. Patissier appears to have some idea of the kind, for he says, "Il vaut mieux travailler dans l'eau, les pieds et les jambes nus, qu'avec des guêtres et des souliers, qui ont l'inconvénient de retenir l'humidité;" and thus will continue to dissipate the heat, when no longer evolved in additional quantity by exercise. Under this section, therefore, we shall consider the consequences of temperature and moisture combined.

The human body, we well know, is susceptible of bearing with impunity considerable extremes of temperature, if the changes from the one to the other be not too sudden. Injurious consequences arise more from imprudence than from necessity, and are particularly incident to bakers, brewers, glass-blowers, brass and iron-founders, and various other workmen. When heated with their work, they very frequently leave the shop, even in the middle of winter, without any additional clothing; thus suddenly obstructing the perspiration, and too often producing rheumatism, catarrhs, asthma, inflammations of the chest, and general dropsy. With the labourers of this class it is very evident that nothing is wanting but common prudence to prevent, for the most part, those inconveniences which must otherwise ensue from their occupations.

But there is another class of workmen who are perpetually exposed to a low temperature, or are obliged to remain for a considerable time together in shops overloaded with vapour, thus moistening their clothes, and rendering them rapid conductors of heat; viz. those whose occupations compel them to work in the open air, and exposed to the frequent alternations of the weather. To these classes belong washer-women, dyers, fullers, water-carriers, gardeners, milkmen, farmers, fishermen, and many others. The diseases of all these are precisely such as we are accustomed to refer to the suppression of cutaneous perspiration: and, in marshy situations, in addition to the disorders mentioned above, we have not rarely intermittent fevers. The steepers of hemp are reported to be liable to intermittents, but manifestly from the exhalation of miasmata similar to those which excite them in fens and marshes.

It would be difficult to mark out any plan for removal of the latter evil, excepting that of steeping as little as may be in one place, and thus diluting the miasmata. With regard to the former, we can only recommend the constant use of flannel, and perhaps a rather freer diet than is necessary under other circumstances. M. Patissier recommends the fishermen to cover themselves with a cloak of cerecloth, "d'une capote en toile cirée," and perhaps it may be useful to them. It is only possible here, however, to give general directions, and the indications are too plain to be mistaken by any one.

[An occupation of this kind has taught us the effects produced by large quantities of fermented liquors. There is a body of men employed on the river Thames, whose business it is to raise ballast from the bottom of the river. As this can be done only when the tide is ebbing, their hours of labour are regulated by that circumstance; and, consequently, vary through every period of the night and day. They work under great exposure to inclemencies of weather; their occupation requires great bodily exertion, occasioning profuse sweating, and much exhaustion. In consideration of this, their allowance of liquor is very large; each man, according to Dr. William Budd, (*Tweedie's Library of Medicine*, 2d Amer. edit., iii. 587, Philad., 1842,) drinks from two to three gallons of porter daily, and generally a considerable quantity of spirit besides. This immoderate consumption of liquors forms the only exception, as far as relates to food, which these men offer to the lower classes in London. Gout is remarkably frequent among them, and although not a numerous body, many of them are every year admitted into the Seamen's Hospital Ship affected with that disease. This, as Dr. Budd remarks, is a very interesting fact, and seems to show that no amount of bodily exertion is adequate to counteract the influence of such large doses of porter; the exposure to wet and changes of temperature probably favouring its operation.]

2. The *second* order of this class comprehends those diseases which arise from undue or excessive exertion of particular parts or organs. Without following M. Patissier's division, we shall shortly treat of the effects of immoderate muscular efforts; immoderate exercise of the voice or sight; occupations requiring long-continued standing; and occupations which require pressure upon, or exercise of, some particular part.

The diseases to which persons are subjected whose employments compel them to powerful exertion of the muscles, are hernia, aneurisms of the heart and great vessels, hemorrhages from the nose and lungs, laceration of muscles, and not unfrequently such injuries of the spine as to produce deformity and incontinence of urine. Of all this array of evils, hernia is the most frequent; M. Patissier mentions that the London Institution for the Relief of Ruptures received, between April 1807 and October 1808, five thousand three hundred and eighty-seven individuals, of whom seven hundred and sixty only were women. From the very general adoption of the steam-engine in this country for the execution of all laborious work, the sources of these accidents and diseases are daily diminishing.

The French are very fond of tracing aneurisms to this cause, and it is possible that they may occasionally proceed from it; but we are convinced that their frequency is much over-rated. Where there is a predisposition in the blood-vessels to this disease, it may doubtless be induced by violent effort to a particular part; but from the comparative rarity of aneurisms in this country, and from their frequently happening in women, where this cause cannot be suspected, we are disposed to believe that they ensue only where there is such a predisposition. Of the other consequences, laceration of the muscles is the most frequent, and is often effected by a very trifling effort; but it is an accident of more inconvenience than importance, if treated by a well-educated surgeon.

Ramazzini has affirmed that a standing posture is a no uncommon source of varices in the legs, Dr. Gosse has published a similar opinion. M. Mérat has remarked also, "that the footmen who stand long behind carriages on the points of their toes — the only attitude by which they can avoid the shocks — are subject to aneurisms of the popliteal artery." In an inquiry like the present, it is of some importance to distinguish between what is merely coincidence, and what stands in the relation of cause and effect. This, we suspect, has been very frequently overlooked by M. Patissier, and, indeed, by French authors generally. We do not doubt that both Ramazzini and Gosse have witnessed varices in individuals whose general posture was standing, nor that M. Mérat has seen popliteal aneurisms in footmen; but does it therefore follow that their occupations were the cause of the disease? We are not aware that varices are more frequent in men than in women; our own experience, indeed, is favourable to a contrary opinion, and their origin we have in very many individuals traced to pregnancy. But when we consider that standing is the position which the most numerous class of workmen employ, that there is, in truth, scarcely any art in which the labourers do not stand for a very great length of time, and yet that varices are very far from bearing any proportion in the diseases of such workmen, it does appear to us that this position must be rejected as their cause. With regard to aneurisms, it is very true that Mr. Hodgson, who is the best authority on the subject, states that men are more liable to them than women; but he likewise states a similar fact as to "those diseases of the coats of arteries, which precede the formation of aneurisms." This again, therefore, seems merely a coincidence. The same observation applies to the occurrence of aneurism in tailors and shoemakers, in whom the citation of a single case is deemed sufficient by M. Patissier to mark it as proceeding from their employments.

Housemaids, from kneeling at their work, are unquestionably liable to a swelling of the bursa of the patella. It seldom, however, proves of any serious inconvenience, though occasionally, from inflammation taking place, it becomes the subject of surgical treatment. It is sometimes early reduced by the application of leeches, but will return soon after the patient has resumed her former employment.

Under the same head we may place those diseases which originate from too violent or long-continued exertion of the voice.

The evils frequently enumerated as arising from over-exertion of the vocal organs, depend, in some measure, upon other causes than mere exertion. From this alone, without question, aphonia may occasionally proceed, œdema of the glottis, hæmoptysis, and laryngeal phthisis; perhaps even herniæ may ensue. But if cerebral congestions or aneurisms of the heart are prevalent among orators, in support of the latter of which, however, the only case that we have seen cited, is that of the celebrated Mirabeau, they are rather to be referred to the effect of the passions. In the same way, M. Hallé has observed that public singers are liable to a series of nervous affections; and here M. Patissier has very properly remarked that the love of music may degenerate into a predominating passion. "Musicians and painters," he says, "are, in general, the most enthusiastic of all artists. We have seen musicians become deranged, and musicomania has been observed by many physicians."

The treatment of the diseases which may be traced to the exercise of the vocal organs must plainly be commenced by a perfect abstinence from the exciting cause; but whatever farther may be required must be dependent upon the circumstances and constitution of the patient; and if the chest is threatened with any serious disorder, which may usually be recognised by the presence of cough and emaciation, the profession which compels the exercise of the voice must be altogether abandoned.

Continued and intense application of the eyes, or their subjection to vivid light, is productive very frequently of the loss of sight, very generally of a diminution of its powers. Watchmakers, microscopic observers, and embroiderers, are often short-sighted. "They are obliged to compress the eye by the muscles attached to the globe, and to make it, consequently, take a more convex form than usual, that they may be enabled to observe more distinctly; and their continual compression produces myopia."

The workers at furnaces and iron-forges frequently become amaurotic, from the great glare of the fires. In all these cases there is evidently no good to be expected from medical treatment, unless the patients abandon their occupations.

3. The *third* and last order of this class, and with the consideration of which we shall conclude the present article, are the diseases attendant upon *sedentary habits*. To enter fully into these, to show the manner in which they are adverse to health, and the proper remedies, would take up nearly as much space as we have already occupied. It can be only an outline which we are now enabled to offer.

The diseases of literary men are those which originate from want of exercise, very frequently from breathing the same atmosphere too long, from the curved position of the body, and from too ardent exercise of the brain. Of these sources of ill health, the last is alone peculiar to them, lawyers, bankers' clerks, &c.; the former are common to them with a considerable number of artisans, as tailors, shoemakers, weavers, watchmakers, jewellers, and a variety of others. But several of these last have likewise peculiarities in their manner of working, such as keeping the body more or less curved, and pressing strenuously against the sternum or pit of the stomach, which materially modify their maladies. After mentioning, therefore, the diseases common to all, we shall briefly notice those which are peculiar.

Perhaps no position, if long continued, is more injurious to health than sitting. The artisans who have practised it from infancy very rarely enjoy a vigorous constitution; their countenances are pallid and leucophlegmatic, and they wear the appearance of old age at that period which is usually considered as middle life. "Sedentary habits," observes Patissier, "usually cause the lymphatic to predominate over the muscular, nervous, and sanguiferous system;" hence scrofula, rickets, cachexia, &c. "Those who labour sitting complain of hemorrhoids and pains in the kidneys : the females are subject to fluor albus and irregular menstruation." In all these individuals, the most common, the most obstinate, and too frequently the forerunner of a more fatal disease, is dyspepsia. In those who are badly nourished, which, however, happens rarely in the great manufacturing towns of England, it takes that form which Dr. Bateman has described under the title of asthenia. Obstipation of the bowels is exceedingly common among all, and to this is unquestionably to be traced the prevalence of hemorrhoids, and, not improbably, affections of the prostate gland. "Their position is peculiarly unfavourable to the functions of the viscera of the abdomen and chest ; it determines dyspepsia. gastritis, obstipation, hemorrhoids, catarrhus vesicæ, and enlargements of the viscera." To these we may add, and so conclude the subject, so far as this class of mechanics are concerned. that, besides the evils arising from their position, many make strong pressure upon the chest and the pit of the stomach. Of this class are shoemakers, weavers of all kinds, button-burnishers, &c. By this pressure, gastrodynia, to a very severe degree, is often produced, chronic inflammation of the peritoneum, and phthisis. The same evils are common, but much less intense, in bankers' and attorneys' clerks, who incautiously lean too strongly over the desk.

Tissot has published a small work upon the Diseases of Literary Men ; and though it contains much that is fanciful, it is certainly deserving of attentive perusal. In addition to the disorders which a continued sedentary position induces, they are liable to many from a too constant exercise of the brain. "Severe, dry, tetrick," says the singular and facetious Burton, "are common epithets to scholars; and Patritius, therefore, in the Institution of Princes, would not have them to be great students ; for (as Machiavel holds) study weakens their bodies, dulls their spirits, abates their strength and courage ;" "they are most part lean, dry, ill-coloured, spend their fortunes, lose their wits, and many times their lives." From Aristotle downwards, the brain has been remarked to suffer peculiarly from this over-excitement ; and there seems no exaggeration in the assertion, that "headachs, arachnitis, apoplexy, mania, melancholy, and particularly hypochondriasis, are its consequences." In the present day there is more general temperance in the pursuit of information ; there is more diversity, and usually more bodily activity. Hence, probably, the ill effects are rare. They are still, however, common ; for, unfortunately, the energy which prompts to industry in accumulating knowledge is almost always conjoined with great moral sensibility. The plan which has served to diminish their frequency may, perhaps, under proper management and adaptation, be successful in entirely preventing them ; and the advice of Ramazzini ought to be written up in the room of every intense student. "Nihil majus salutare censeo, ac magis commendo, quam corporis exercitium quod nihil prestantius ad obstructiones expediendas, nativum colorem roborandum, coctiones perficiendas, transpiratum promovendum, et scabiem fugiendam."

[The diseases with which the literary are specially afflicted are those to which the sedentary are liable, even when the intellect is suffered to lie dormant ; and, accordingly, dyspepsia and its gloomy concomitant, hypochondriasis, with general torpor of the digestive apparatus, are the common results : but these diseases are by no means liable to destroy ; and it may be affirmed, that literary men, as a body, attain as high a degree of longevity as men of any other avocation. In antiquity, this fact was most remarkably established, and all our associations of ancient wisdom are attached to the hair whitened by time, and to those venerable and venerated busts which exhibit the characteristics of the accumulated wisdom of ages. Germany affords an example of a class of men who devote themselves, from an early age, to literary pursuits exclusively, and their longevity has been every where a subject of comment. It has, indeed, been maintained, and with much evidence in its favour, that the pursuit of letters in Germany, as every where else, is eminently favourable to longevity. Blumenbach affirms that for the half century and more of his connexion with one of the most celebrated universities in Europe, he had not known a solitary example of any youth falling a victim to his ardour in the pursuit of intellectual distinction ; and Eichhorn, one of the most voluminous writers of his day—the eminent philologist and historian—is said to have asserted boldly, "that no one ever died of hard study." "The idea," said he, "is preposterous. A man may fret himself to death over his books, or any where else, but literary application would tend to diffuse cheerfulness, and rather prolong than shorten the life of an infirm man." The writer's experience is completely in accordance with that of those observers. He cannot, indeed, recollect a solitary case of serious mischief induced by too great intellectual exercise, although the cause has not unfrequently been assigned. Where the health is apparently injured by literary pursuits, it will be found that the evil is dependent rather on collateral circumstances, on irregularity of habits, as regards eating, drinking, or sleeping, often acting upon a frame unusually susceptible of impressions, for such is a frequent accompaniment of genius ; and, that these views are just, is strongly corroborated by examining the history of female authors, most of whom have been extremely long lived ; doubtless, in a great degree, because they were exempt from that irregularity of life which history shows to have been so destructive to many of the poets, whose productions have appeared in youth, and the celebrity arising from which had led them into society, and into habits that have too frequently been most destructive.

It is probable that literary occupations cannot be closely pursued with the same impunity in the young as in the adult. When study is indulged to excess in early life, it may have a tendency to induce a predominance in the nutrition of certain organs at the expense of others. If any organ be energetically exercised, its vital activity is exalted, and a larger afflux of blood takes place towards it, so that it attains a greater degree of development than where it is less used. Hence, it can be conceived, that a constant over-tension of the intellectual powers, especially when conjoined with irregularity in exercise, diet, sleep, &c., may occasion augmented flow of blood to the brain, and consequent disease of that viscus, even in the adult. Still more likely is this to ensue, if the same application be made before the organs have undergone their full evolution; and hence we may conceive that early and intense study may lay the foundation to faulty development in other parts of the frame, and to great energy of nutrition in the brain. But whilst it is admitted that such may be the case, it probably happens but rarely, far less frequently than is believed. (Dunglison's *Elements of Hygiène*, p. 474. Philad. 1835.)

Dr. Guy, in the Journal of the Statistical Society of London, (cited in the *Provincial Med. and Surg. Journal* for Dec. 16, 1843; and in the *Philadelphia Medical Examiner* for March 9, 1844,) has entered at some length into an inquiry on the influence of employments upon health. It confirms the results arrived at by other observers, in showing the great advantage which the better classes enjoy over other members of society. They appear to have longer, and probably enjoy better, health. This is doubtless owing to better ventilation and food, and the greater attention bestowed on the places which they inhabit. It is partly also due, as Dr. Guy has suggested, to the facilities which they enjoy for exercise in the open air. The great difference between the gentry and other members of society is not more worthy of notice than the slight advantage which the tradesman in Great Britain enjoys over the class of workingmen: according to Dr. Guy, if we limit the comparison to the average age, we find that the tradesman lives about three quarters of a year longer than the entire class of workingmen—little more than a year and a half longer than the class employed solely within doors—two years longer than the men following the more sedentary occupations, and about three years longer than the class which consists chiefly of domestic servants. On the other hand, the life of the tradesman is shorter by about a quarter of a year than that of the entire class of out-door labourers. The little advantage possessed by the tradesman over the mass of workingmen, Dr. Guy thinks, probably results from the sedentary life he leads, his want of proper exercise, and the small space which the necessities of business allow him to appropriate to the accommodation of himself and family. Taking one tradesman with another, it is, perhaps, not unreasonable to suppose that he habitually breathes an air as impure, and follows an occupation nearly as unwholesome, as the class beneath him. The labour which the workingman has to undergo, provided it is not carried to excess, is more favourable to health than the confinement to which the tradesman is subject; and this confinement raises him in the scale of mortality but little above men following the more sedentary occupations. Both classes of men, the tradesman and the workingman, are doubtless exposed to unwholesome influences, which might be wholly removed or greatly mitigated by the interference of others, or by their own precautions.]

In closing this article, we cannot omit to notice that the different employments of life are rendered far more pernicious than they would otherwise be, by the intemperance of the individuals exercising them. Even the grinders, by their constant drinking, greatly increase the injuriousness of the small particles which they respire. The bronchial tube is already predisposed to inflammatory action, and perhaps scarcely requires the additional irritation of a foreign body. Among those who exercise their intellectual faculties the same observation holds equally good. There is indeed no question that mental exercise renders the brain incapable of bearing that stimulus which otherwise might perhaps be borne with impunity. A few years ago a gentleman, fifty years of age, who had the care of very extensive concerns, applied for assistance on account of giddiness in his head. He did not consider himself intemperate, yet he was in the habit of drinking three or four pints of strong ale daily, and this his father, an old man of ninety years of age, had done for years without any inconvenience. The difference, however, in their habits was great. The father, concerned in agricultural pursuits, had little care, while the son was called upon to exercise his mind continually and intensely. Fortunately it was not too late to point out the error; and a change of habits has preserved him from any repetition of the attack.

Such, then, is an outline of the evils to which mankind are subjected from their occupations; and numerous as they are, it does not appear that any are really and entirely unavoidable. Ingenuity has already diminished the number, and may, perhaps, do so still farther; but it cannot be too much impressed upon all, that more depends upon the individual than upon the occupation. In many trades cleanliness will alone be sufficient; and with this and common prudence, few, perhaps, of the employments of men would be injurious to health.

J. Darwall.

ASCARIDES. See Worms.

ASCITES. This term is employed to designate abdominal dropsy, [dropsy of the peritoneum,] and is the same with the Greek word ἀσκίτης, which has been derived from ἀσκὸς, a bottle.

Few subjects are involved in greater disorder than that of abdominal dropsy: authors the most esteemed have used the word ascites for every kind of collection of fluid in the abdomen. We shall in the present article confine the word ascites to effusion within the cavity of the peritoneum, referring to their proper place *ovarian dropsy* and *dropsy of the uterus*, which, though distinct affections, have hitherto been considered under this head.

The fluid effused in ascites consists of serum, exhibiting various degrees of colour, from a light citrine to a deep brown. Occasionally the serum is mixed with pus, and not unfrequently there are flocculi of coagulable lymph. This last state denotes that there has been inflammation of the peritoneum.

Diagnosis.—The abdomen in ascites usually begins to swell very gradually; the swelling is uniform, beginning from the pubes, and gradually extending as high as the ensiform cartilage. In the first instance the abdomen is prevented from protruding very much by the strength of the muscles, but as the accumulating fluid increases, it overcomes their resistance, and a large pouch is formed, depending in some instances considerably below and in front of the os pubis. If at this stage the left hand is placed on one side of the abdomen, and the other side is sharply struck with the right hand, a sense of fluctuation is manifest, such as cannot very often be mistaken. To use, however, the expressive words of Heberden, "neque tamen nullus est errori locus in hac re," and mistakes have been made, by which pregnancy has been mistaken for ascites, and ascites for pregnancy. The former mistake is unquestionably the most important, since, should paracentesis be carelessly practised under such circumstances, the death both of the mother and the child might be the consequence. The latter is not, however, without its inconveniences, for every disease is most easily overcome in its commencement, and hence an error in the diagnosis may cause a very serious loss of time.

To distinguish pregnancy from dropsy, nothing more is usually required than an accurate knowledge of the signs of the former; but sometimes a difficulty of another kind exists, namely, the presence of ascites with pregnancy. In this case, in the language of Scarpa, "the regular form and body of the uterus is not evident to the touch; principally from the enormous distension and prominence of the hypochondria, arising from the great quantity of fluid interposed between the fundus and the posterior part of the uterus and abdominal viscera. The urine is scanty and lateritious, the thirst is constant. The abdomen upon percussion presents a fluctuation, obscure in the hypogastric region and in the flank, but sufficiently sensible and distinct in the hypochondria, and strong and vibrating in the left hypochondrium, between the edge of the rectus muscle and the margin of the false ribs." The previous history of the case, with a proper examination of the neck of the uterus, will enable the practitioner to decide upon the combination of pregnancy and ascites; [yet a case occurred to Dr. Haighton and to Sir Astley Cooper, in which these gentlemen were so far deceived as to appoint a day for the operation of paracentesis, when fortunately, in the mean while, the lady was taken in labour and delivered. The discharge of liquor amnii was enormous.]

Another important distinction is between ascites and encysted dropsy, whether ovarian or from any other cause. The history of these cases will generally afford sufficient information for an accurate diagnosis. In ovarian dropsy, the swelling does not begin from the lower part of the abdomen, nor is it uniform, one side or the other being most protuberant. Should several cysts exist, the parietes of the abdomen often feel tuberculated, and we are sensible that its cavity has several partitions. Moreover, when the patient turns from one side to the other in bed, a sensation of a heavy weight within the abdomen, falling to the lower side, is perceived; if the cysts be attached higher up, a feeling of dragging is induced, almost amounting to pain. Hence patients generally lie on the side on which the attachment exists. In some instances, a hard tumour is remembered to have preceded the distension of the abdomen. When the cysts are few and very large, the distinction is exceedingly difficult, and sometimes altogether impossible. Even then, however, an accurate investigation of the history will generally explain the exact nature of the tumour.

Encysted dropsy has also its origin in the liver, to the lower edge of which large masses of hydatids are occasionally attached. In investigating this affection, attention must be paid to the course of the disease and the direction of the swelling. In the very early stage it is not likely to be mistaken for ascites; but as the parietes of the abdomen become thinned, the presence of a soft swelling proceeding from the liver, and sometimes exhibiting a slight degree of fluctation, may be traced. The history, however, of the tumour will afford some information. In ascites the swelling proceeds from below upwards, while in the encysted dropsy of the liver its progress is from above downwards. A more particular prominence of the abdomen may be perceived on the right side. To this also is to be added, that the general health, as in ovarian dropsy, is but little affected, that the disease is usually of very long duration, that the urine is passed in the natural quantity, and that real effusion either into the cavity of the peritoneum or into the cellular texture does not take place till a very late period of the disease.

The gall-bladder has been much enlarged, and Mr. Gibson has related a case, in the Edinburgh Medical Essays, in which it contained eight pounds of inspissated bile.

Hydatids form upon the spleen, and may equally give rise to encysted dropsy, as when attached to the liver. Dr. Donald Monro has related a case in which "a scirrhous spleen was beset with two little bags full of water, which weighed a hundred and twenty-six ounces;" and in the case related by Mr. Gibson, a cyst was attached to the spleen containing six pounds of clear serum, without smell, but exceedingly coagulable.

The omentum and the sides of the intestines are likewise the site of encysted tumours, which, when they become large, may be mistaken for ascites. It is not very easy to lay down any symptoms by which these can be distinguished from true ascites in their advanced stage; but an investigation of the history of the disease, and a careful examination of the tumour, will, in this case also, generally enable us to ascertain its nature. The tuberculated feel which we have mentioned as marking the ovarian dropsy may be frequently perceived in these affections, and little inconvenience is experienced excepting from the bulk and weight of the swelling.

The distinction of the encysted form of dropsy, if this ought to be called a dropsy, is highly important in the treatment of the disease; for while real ascites or effusion within the cavity of the peritoneum is very amenable to medicine, scarcely any benefit can be afforded to encysted dropsy, and our chief attention must be paid to the general health of the patient. Medicine indeed is much more frequently injurious than useful in encysted dropsies, when they exist alone. In the later stages, however, real ascites is usually conjoined with encysted dropsy, either by the bursting of the cysts into the cavity of the peritoneum, or by an increased secretion from that membrane itself. We have seen this occur in a case of ovarian tumour, in which, from the extent of the effusion, the tumour for some time could not be perceived, although it had previously been easily felt. Cases of this kind are of course to be treated on the same principles as dropsy of the peritoneum from any other cause.

It is scarcely necessary to mention the distinction between ascites and tympanites, the latter being easily known by the clear resonance afforded when the abdomen is struck by the hand, and the tense, light, and equable intumescence of the abdomen. The collection of air within the cavity of the peritoneum is an exceedingly rare occurrence, though we can hardly doubt that it has occasionally been met with; but the contrary is the case with large accumulations of air in the stomach and intestines, and more or less of this form of tympanites occurs in ascites itself. It is not, however, a symptom peculiarly demanding consideration, nor admitting, when thus united, of any particular treatment. It generally indicates some disease of the liver, of which it is a very early symptom, and frequently precedes the ascites.

Ascites, whether idiopathic or sympathetic, appears united with two different states of the system—the one tonic, the other an asthenic state. In the former there is more or less of an inflammatory condition of the peritoneum; in the latter no inflammation is present; and if we attribute, as Dr. Parry would do, the effusion in this case also to increased momentum, it can only be comparative, with relation to the weakened state of the exhalents, since, to employ his own words, "the effusion is not always proportioned either to the mere disposition in the capillaries of the part, or to the degree of increased momentum, but is relative to the sum of the two together; and hence, in certain states of the capillary system, even the healthy impetus may be sufficient to cause effusion." The symptoms of ascites necessarily vary with its cause, and we shall therefore proceed to consider them under the different heads of idiopathic and sympathetic, tonic and asthenic ascites.

Idiopathic, tonic, or acute ascites.—This species of ascites exhibits different symptoms, according to the exciting cause and the constitutional irritability of the patient. In some instances there is little disturbance of the general health, the swelling of the abdomen being the principal symptom that attracts attention. Dr. Ayre has related an example of this kind in a young woman, in whom it had only existed for three weeks. Her general health was not much affected, but the pulse was somewhat increased in its force and frequency. He succeeded in curing her in the course of a fortnight, by leeches and blisters, and by acting at the same time briskly upon the bowels and kidneys. At other times it is more evidently inflammatory, and connected with, if not dependent upon, inflammation of the peritoneum—it is accompanied by fever, pain in the abdomen, increased by pressure, and by a hard, sharp, and sometimes a wiry pulse. This form of the disease is generally attributed to cold, and sometimes runs its course in a very short time. Several years ago a young man, (twenty years of age,) labouring under this species of ascites, came under our care. Three weeks only had elapsed when the patient applied for relief. From his report he had at first experienced only the symptoms of catarrh, to which in a few days succeeded pain and swelling of the abdomen. He was bled immediately, and aperients were given, after which the effusion disappeared. The original cause of the effusion, however, had proceeded too far to admit of recovery. He gradually sunk; and, upon examination after death, the peritoneum was found to be inflamed, and much coagulable lymph thrown out, so that the bowels were in many places agglutinated.

Idiopathic inflammatory ascites occurs also after scarlatina, and is sometimes the principal form of effusion, although it is always accompanied with some degree of anasarca. The progress in this case is again different from the two forms already noticed. It usually appears very gradually, commencing about nine or ten days after the disappearance of the eruption, and for some days it is scarcely apparent. There is at this period a suspension of convalescence, which had previously been progressive; the appetite fails; the tongue is covered with a white fur; the pulse is quickened, and there is much thirst. This may continue for several days before the effusion in the peritoneum is considerable enough to attract attention; and the first symptom is an inability of bearing pressure upon the abdomen. When the bowels are now examined, they will be found very slightly protuberant, but without fluctuation being perceptible; there will be tenderness upon pressure, although no complaint should have been made of pain in the bowels: sometimes, however, patients do complain of this pain, but it is usually mistaken for slight colic, and no notice is taken of it. The bowels are costive, the evacuations very offensive, and the urine is scanty, and generally pale; upon boiling it, it always deposits a greater or less quantity of albumen. The face is generally œdematous, particularly in the morning, while the contrary state has place in the legs and ankles, they being œdematous at night, and nearly or quite free from œdema in the morning.

These, perhaps, are the simplest forms of ascites that can occur, nor can there be any difficulty in ascertaining their origin, or their appropriate mode of treatment.

There is, however, another species of idiopathic ascites, the origin of which is not very manifest, nor can we do more in this place than indicate its existence. It is unaccompanied by the slightest degree of anasarca; it commences very suddenly, without any marked disorder of the general health, without any precursory symptom, and without any ascertainable exciting cause. During the last year a workman in one of the Birmingham manufactories was the subject of this species of ascites, and his abdomen was as much distended in twenty-four hours as that of a woman in the last month of pregnancy. The pulse remained natural, the tongue clean, and the appetite good. The alvine evacuations were clay-coloured, and entirely destitute of bile. Venesection was practised, rather as a matter of precaution than from any direct indication, but without any apparent good or bad effect. The evacuations having indicated some hepatic derangement, mercury was given him, but scarcely to affect his mouth. Under this treatment the effusion gradually disappeared, and for some weeks he seemed to have regained his usual state of health. Between two and three months afterwards he was reported to have suffered from hæmoptysis, but the result has not been ascertained.

There is another form of ascites, most common in children and young girls about fifteen or sixteen years of age. In very many cases there is no symptom attending the effusion; in others there is considerable dyspepsia attended with much weakness. There is not often any anasarca. The urine and the evacuations from the bowels are either quite healthy or quickly become so under the use of aperients and tonics.

It is not very easy to obtain an accurate history of the cases, for they are seldom brought for assistance till after the effusion has endured for some time. Their early progress attracts no attention, and we may consequently infer that the effusion takes place very gradually.

Idiopathic asthenic ascites.—This is unquestionably a much rarer disease than the acute form, and generally succeeds exhausting causes, as profuse menstruation, long-continued diarrhœa, &c. The effusion usually begins with œdematous swellings of the lower extremities, and the ascites succeeds in a longer or shorter time; sometimes, however, the ascites precedes the anasarca. The constitutional symptoms of these cases are loss of appetite, great debility, low, weak, and often fluttering pulse, and in women, with whom it much more frequently occurs than in the opposite sex, it is united with distressing hysteria. At the same time the digestion is very greatly impaired, and solid food is either rejected, or complained of as inducing severe pain. Flatulence is also a very distressing symptom in this form of ascites. The bowels are very irregular, either very costive or relaxed, and the exhibition of purgatives invariably increases the general disturbance of the system. If the disease be suffered to proceed without medical assistance, the effusion continues to increase, and the patient at length dies from exhaustion.

The forms now mentioned are the chief species of idiopathic ascites; and we next proceed to the consideration of sympathetic ascites. In this we cannot equally divide the disease into tonic and asthenic; since, generally speaking, the asthenic character predominates, but in a state of the system so irritable that inflammation often supervenes.

Sympathetic, or more properly, perhaps, consequential ascites, is always the result of some previous disease of an important organ, and is the result of the debility of the system induced by such disease. The effusion is preceded by greater languor than had been experienced before—thick dry skin, diminution in the quantity of urine, and as the effusion increases, by a distressing dyspnœa, the consequence of the impeded action of the diaphragm from the pressure of the fluid. The swelling of the abdomen is often preceded for weeks and months by an œdematous state of the ankles, particularly at night; and this sometimes will be wanting for a short time, so that the patient flatters himself that it will not re-appear. At length, however, the œdema of the feet and ankles becomes permanent, and extends a little way up the legs; and at the same time the abdomen becomes a little fuller, the patient cannot button his clothes, or, in the female, the stays will not come together. From this period the progress is more rapid, the abdomen daily becomes more distended, and fluctuation is soon manifested. Emaciation increases with the effusion; hectic fever, if it should not have appeared before, is established; and the patient gradually wastes away.

The duration of dropsy, in this last case, is very various. In general it appears long before the fatal termination; but not unfrequently the effusion appears only a few days before death, and the quantity of fluid poured out in a short time is surprisingly great. From our experience we should think that this rapid effusion chiefly occurs as a consequence of diseased liver, in persons naturally of strong constitutions. We have never seen it equally rapid when it has depended upon the affection of any other organ.

Causes of Ascites.—The arrangement which we have followed does not allow us much to dilate upon this point. The acute species are clearly dependent upon inflammation of the peritoneum; and we are induced to believe that, in many instances at least, this is the primary affection. Dr. Bright, however, is inclined to refer the origin of these inflammatory dropsies to disease of the kidneys, and to consider the inflamed state of the serous membranes as only an accidental circumstance. The more detailed consideration of this doctrine we shall defer to the article DROPSY, only here indicating the hypothesis. We would, however, remark that albuminous urine, which Dr. Bright considers as diagnostic of renal dropsy, much more frequently accompanies anasarca than ascites; although the latter, especially when the consequence, exhibits the same peculiarity.

The exciting causes of acute ascites are cold, intermittent fevers, the retrocession of eruptions, especially when they have disappeared rather earlier than they ought to have done, the suppression of habitual discharges, &c.

The asthenic dropsy we have already referred to diarrhœa, hemorrhages, &c. by whatever cause excited; and the sympathetic ascites, as the epithet indicates, is rather a symptom than an original disease.

Morbid appearances.—The morbid appearances exhibited in ascites are almost innumerable; every derangement of an important organ may sooner or later give rise to this form of dropsy—the liver, however, the spleen, and the kidneys, are more particularly concerned in the production of effusion. In the peritoneum, which is the immediate source of ascites, the presence of inflammation is often proved by a false membrane being attached to it in different parts, and by the agglutination of the bowels. It is also subject to thickening, and instances are on record where it has become almost cartilaginous. Dr. Ayre has related a case, in which the dropsical symptoms had disappeared twelve months before the death of the patient, which took place in consequence of an old liver disease. On inspecting the body after death, the peritoneum covering the liver, and the organs adjoining it were found of a nearly perfectly white colour, and of the thickness of chamois leather, and this appearance pervaded, more or less, the whole abdomen. In the museum at Guy's Hospital, there is a preparation of a portion of the convex surface of the liver, and of the diaphragm corresponding to it, showing the peritoneum covered with minute scabrous elevations. In this case "the patient had copious clear effusion into the peritoneal cavity." Another preparation of the peritoneum in the same museum, taken from a dropsical patient, exhibits a portion of the membrane covered with small scrofulous tubercles. Steatomatous and scirrhous excrescences on the peritoneum are also found in ascites; and probably, in all these cases, the diseases of the membrane are the causes of the effusion.

Prognosis.—The prognosis of ascites must necessarily depend upon the cause, and in general the idiopathic disease is curable, whether of the tonic or the atonic forms; while, on the contrary, the sympathetic form of ascites very seldom admits of a cure. It may, indeed, be removed for a time; and, in some rare cases, when the original disease has been likewise removed, it has not returned: it must be confessed, however, that this is a very rare occurrence. In general, the effusion returns very quickly, and of the sympathetic ascites, we may say with Itard, that it is almost always mortal. This difference in the prognosis renders it very important to distinguish between the idiopathic and sympathetic disease; a distinction which it is not in every case easy to make, and which consequently demands the closest investigation on the part of the physician.

Treatment of Ascites.—The treatment of ascites must vary according to the origin of the disease. In the idiopathic and acute form, bleeding, either general or local, or both, must be recurred to. When ascites is produced by cold, and in plethoric habits, general bleeding should never be omitted; and should the distension of the abdomen continue unabated afterwards, with a tolerably firm pulse, the depletion may be repeated. If there is tenderness in the abdomen, it will be often highly serviceable to apply a large blister over this part, and sometimes to keep it open, or to repeat it. In the dropsy succeeding scarlatina in children, the application of leeches will be generally sufficient, provided they are applied in considerable numbers. In a child under five years of age, from six to eight may be ordered; but after this period from eight to twelve should be employed. In stating these numbers, it is not intended that they should be permitted to bleed afterwards; for so much inconvenience is often experienced from the indiscretion and carelessness of nurses, that it is much better to apply a larger number, and to stop the bleeding immediately. In two instances, where only four leeches were applied and the leech-bites were left to bleed afterwards, the patients evidently sunk exhausted from the loss of blood.

Mercurial purgatives should be administered in the first instance, until the bowels have been completely emptied, after which it will generally be advisable to suspend the use of active purgatives, and to order diuretics. Of these the digitalis purpurea is unquestionably the most useful; and in the dropsy after scarlatina, it is almost a specific. The coagulability of the urine, which may have resisted bloodletting and purgatives, rapidly disappears during the administration of digitalis, and the effusion disappears at the same time; sometimes, however, the coagulability of the urine remains long after the dropsy. There are cases in which so much debility remains after the employment of these means, that tonics become necessary, and in this case bark or steel is the most efficient. Great care should be taken that the use of tonics is not permitted while the febrile state remains, since they might then perhaps reproduce the effusion.

In the idiopathic asthenic ascites, the first attention must be paid to the exciting cause, whether this be hemorrhage, diarrhœa, menorrhagia, &c.; and, as far as it may be possible, this should be removed. As the term asthenic indicates, tonics are absolutely necessary for this form of the disease, but much care is required in our choice of the particular remedy. When the debility is very great, and the irritability is at the same time considerable, the stomach will seldom bear the more powerful tonics, such as quinine, the sulphate of iron, or the stronger vegetable bitters. Under these circumstances it will be advisable to use the mildest bitters, and these very weak, such as infusion of calumba, infusion of orange-peel, &c. and to recur to the more powerful remedies, as the strength increases. In those cases of weakened digestion which occur among the poor, and to which Dr. Bateman gave the title of asthenia, the decoction of Iceland-moss will often be found very beneficial, this medicine possessing the double qualities of a nutriment and a tonic. A very serviceable remedy also is the ferrum tartarizatum; it acts at the same time as a tonic and a diuretic, and is decidedly the mildest of the preparations of steel. It affords very considerable relief in those cases of anasarca which are connected with disturbed action of the heart, and where it would be dangerous to give any stimulating tonic.

In that form of ascites which has been mentioned as occurring in children and young girls, the most satisfactory results have been noticed from the administration of Bacher's pills. This remedy, which once obtained considerable celebrity, is composed of equal parts of the extract of black hellebore and gum myrrh, with a small portion of the carduus benedictus in powder. The latter, however, is void of all power, and, perhaps, owed its introduction as much to its title of *benedictus* as to any thing else. It is now rarely kept in the shops. The dose is a one-grain pill three times a day; afterwards to be increased, if the patient can bear it, to four or five pills at a dose, and given as frequently.

The action of this medicine upon the various secretions is not evident. Sometimes the bowels are slightly relaxed, and sometimes the urine is increased; but quite as commonly there is no difference in these respects; and yet the effusion gradually disappears. There are, however, individuals upon whom the black hellebore quickly acts as a poison, inducing giddiness, sickness, and sometimes, but not very frequently, purging; and with such persons we are obliged to adopt a different mode of treatment.

It may be laid down as a rule in this as in all other chronic diseases, that nothing is to be obtained, but much may be lost, by violent and hasty remedies. Even when relief is afforded by them, as sometimes happens, it is at the risk of inducing worse evils. When, therefore, either Bacher's pills fail, or when from the idiosyncrasy of the patient, they cannot be taken, our first object must be to investigate very accurately all the circumstances of the patient; the state of digestion; the condition of the urinary and alvine secretions; and likewise of the cutaneous perspiration. If any one of these is more particularly affected, our attention should be directed to restore the healthy function; to excite perspiration, to improve the digestion, to increase or correct the secretion of urine. For the first object, the common vapour bath, at a heat of from 104° to 110° Fahrenheit, may be advantageously employed. Whether what are termed vegetable medicated vapour baths have any peculiar virtue may be questioned, but there is no doubt that passing the steam through some aromatic herbs renders the bath a much more agreeable application. The bath in this form may be taken every day, or two or three times a week only, according to the strength of the patient.

In exciting the urinary secretion, great assistance is sometimes derived from small quantities of the blue pill, carried far enough just to affect the mouth, but not to induce complete salivation. With these may be combined the various diuretics, as squill, digitalis, nitrous ether, liquor ammoniæ, acetatis, &c. It has often been remarked that diuretics bear, or we might almost say, require combination more than any other remedies, to produce beneficial effects; and our experience amply confirms this opinion. Any one of these alone will perhaps have no effect, but when employed in union with other medicines of the same class, a remarkable increase in the flow of urine is the consequence. This peculiarity must therefore be kept in mind in prescribing; and we must also remember that, to obtain any good result, we must often persevere for several weeks, changing our medicines every four or five days when they cease to excite the kidneys, or continuing the same remedies when their effect continues.

It may often be advisable to act upon the kidneys even when no diminution is perceptible in the quantity of urine voided; as must be evident, if we consider that this is generally the easiest mode of carrying off effused fluid. If the digestive organs appear to suffer, the common plan of treatment of dyspepsia must be recurred to, for which we refer more particularly to the article upon that subject. We would, however, remark that the biliary secretions are generally more or less disturbed in every species of dropsical effusion, and that much benefit is frequently derived from the employment of the nitro-muriatic acid in decoction of sarsaparilla, combined with alterative doses of the blue pill.

To lay down any plan for curing sympathetic ascites without curing the original disease would be idle; whatever is done for the dropsical effusion can merely relieve the immediate distress, and perhaps afford time for removing the essential disease. For this purpose the drastic purgatives, such as elaterium, the croton oil, and gamboge united with calomel, will be found useful;—sometimes frictions, either with oil alone or some stimulating remedy, may be employed: diuretics, though less certain and less speedy in their effects, will also sometimes afford relief.

Mercury is usually administered by empirics in every kind of dropsy, and sometimes in obstinate cases of ascites, with great success. Great caution ought, however, to be observed in the employment of this drug, for by increasing the debility, it may in some cases increase the effusion. To enumerate all the remedies that have been recommended for ascites would render this article unnecessarily prolix; but as some have been mentioned which act with great energy, it may be necessary to give a statement of those the action of which is less decisive, and which require a long perseverance to produce any good effect.

To this class belongs more particularly the supertartrate of potash, which was tried with great success by the late Dr. Home. It should be given in drachm doses in the form of electuary, and as much as from one to two ounces may be taken in the course of the day. Diluents should also be plentifully employed, or the cream of tartar will act on the bowels only, without affecting the kidneys. The decoction of broom, or spartium scoparium, is a very popular remedy, and will in many instances remove the effusion, when other remedies fail. The decoction should be made of the green tops, and drunk for a considerable time in large quantities. It usually affords relief in a few days, by increasing the flow of urine. Occasionally it is beneficially joined in decoction with parsley, apium petroselinum, and the root of the common dandelion, leontadon taraxacum. This, indeed, is a common drink in many country places, and deservedly enjoys a high reputation for the removal of dropsical effusions.

Opium, both alone and in the shape of the compound ipecacuanha powder, has at times appeared to produce singularly good effects in the cure of ascites. Its action, when any good is produced, is powerfully sudorific. Dr. Monro has given the case of a man who, after quartan ague, was taken with ascites, and then swelled all over. A number of purgatives and other medicines were given, but did not at all relieve him; and there seemed to be little hopes of his recovery. Dr. Knight ordered him a dose of Dover's powder, which relieved him greatly, producing at the same time very copious perspiration; and by the alternation of this powder with purgatives, the man eventually recovered. Frictions with oil have likewise been recommended, and a case is given in the Philosophical Transactions, where this alone sufficed for the removal of an old case of ascites. (Phil. Trans. vol. xlix.)

In the article Dropsy we purpose to consider the remedies employed in this disease more fully, and to that article, therefore, we beg to refer the reader for any additional information that may be required.

The last point to which we shall call attention in the present essay is paracentesis. This operation, although one of the oldest in surgery, had, in the time of Dr. Mead, fallen into great disrepute, when that learned physician pointed out the circumstances which rendered it pernicious, and the proper means of remedying it. Our present question, however, is, under what circumstances it ought to be performed, whether as a curative or merely an alleviative measure. It is somewhat curious that the first patient on whom Dr. Mead tried this operation and maintained pressure afterwards, recovered, and that, in another instance, which appeared almost hopeless, he met with similar success. Still this has not been the general experience of the practice; and Dr. Fothergill, about the middle of the last century, acknowledging the little success that had generally attended the operation, thought that it incurred some part of its disgrace from its being delayed till it could have no other effect than procuring a very short-lived hope to the patient. In pursuance of this opinion, he recommended the operation in several cases of ascites, which terminated successfully. Since, however, Dr. Fothergill wrote, the operation appears by no means to have increased in reputation. Our own experience is decidedly opposed to it. We have frequently had patients tapped when the effusion was very inconsiderable, and had existed but a short time. Every care was also taken, after the operation, to prevent the occurrence of inflammation. In all these instances, however, the effusion rapidly recurred, and upon examination of several after death, the bowels were found adhering by old depositions of coagulable lymph. That recovery does occasionally take place after tapping is true; but from extensive inquiries among medical men, and from our own practice, we are convinced that such cases are rare, and we could almost go farther, and say that tapping even increases, in many cases, the tendency to effusion. In looking also at the cases mentioned by Dr. Fothergill, it will be found that they are such as are generally curable without an operation; and to tap such patients would, therefore, be to add to the danger of the disease.

To these remarks some exception perhaps may be made when ascites is conjoined with pregnancy. The distension in this case is productive of so much inconvenience, and even danger, that if the dropsy does not readily yield to the appropriate remedies, no delay should be permitted in performing the operation.

Whenever paracentesis is performed, the greatest care should be taken to prevent inflammation, nor should the appropriate medicines be omitted. Generally, indeed, the kidneys act with great freedom after this operation, gradually, however, diminishing their activity as effusion again ensues. Hence it becomes necessary again and again to repeat the operation, and in some very rare cases a perfect cure has taken place after repeated tappings. The quantity of fluid evacuated by this operation has been enormous. Dr. Mason Good has collected some very remarkable instances. In an instance quoted from Dr. Stoerck, twelve gallons and a half were evacuated at once; and Dr. Scott, of Harwich, performed the operation twenty-four times in only fifteen months, and drew off a hundred and sixteen gallons in the whole.

[The operation has been performed in the same case one hundred and forty-three times, and perhaps oftener. Not long ago, a case was reported to the Académie Royale de Médecine, of Paris, by M. Lecanu, in which paracentesis was performed eight hundred and sixty-six times, and the woman was ultimately cured under compression of the abdomen. In one case, recorded by Dr. Beall, of Missouri, it was performed ninety-six times within a few years, and the whole amount of fluid evacuated was two hundred and seventy-five gallons and a half; the first fifteen operations yielding an average of twenty quarts. (Dunglison's *Practice of Medicine*, 2d edit. p. 205; Philad. 1844.)

For evacuating the fluid, Dr. Prichard, of Bristol, England, (*Lond. Med. Gaz.* Mar. 25, 1842, p. 29,) uses a needle, with a larger groove than the common exploring needle employed in empyema, (q. v.,) with which he has evacuated the fluid of ascites with perfect ease and safety; and with the advantage, that the pain attending the operation is so trifling, that the patient will call, occasionally, for a repetition of it, after having once experienced the relief that follows its use. He recommends, that both in ascites and hydrothorax, it should be used much earlier than the trocar is generally advised; the practice of deferring paracentesis until all other means have been long tried, being, in his opinion, a principal cause of the frequent return of the effusion. Dr. B. Babington employs a very small trocar and canula, which, together, are not thicker than an ordinary grooved needle. The instrument is provided with a probe to pass through the canula. (*Lond. Lancet*, April 9, 1842, p. 60.) After the operation, opportunity is afforded for examining into the condition of the abdominal viscera, and every endeavour should be made, by appropriate revulsion, to prevent a re-accumulation of the fluid. Great advantage, in such cases, has resulted from change of air, as from one of the crowded cities to a watering-place, where the individual can experience a thorough mutation of all the influences surrounding him.]

There are also examples of the spontaneous disappearance of ascites after some accidental hemorrhage, diarrhœa, or other discharge. But the most curious, perhaps, on record is that related by Dr. Mead. At one operation twenty pints of clear fluid had been drawn off. In a few weeks the patient filled again, and it was resolved to repeat the tapping. When, however, the surgeon went the next day, the abdomen had completely subsided, although no evacuation of any kind had taken place in the night. Cases like these serve to bring into doubt the power of medicine.

J. Darwall.

ASPHYXIA.—The term asphyxia is a palpable instance of the change which the signification of a word may undergo in process of time from that which is indicated by its etymology, and which it must undoubtedly have borne when it was first introduced into the language. Being derived from σφύξη, the pulse, with the privative α, its literal meaning is a loss or suppression of the pulse, and, consequently, a failure in the action of the heart. But this disordered state in its simple form is now universally designated by the terms *syncope*, *leipothymia*, or *fainting*. *Asphyxia*, on the other hand, is restricted to express those cases of cessation of the heart's action which arise from a particular cause, namely, the interruption of respiration, or, to speak more correctly, the interruption of the effect produced by that function on the blood.

It is sufficiently established by the researches of modern physiologists, that the purpose of respiration is to expose the portion of the blood which has returned to the heart after it has circulated through the body, and which has acquired, in the course of that circulation, the properties of dark or venous blood, to the influence of atmospheric air in the lungs. The oxygenous portion of the air so received in the lungs, converts this venous blood into florid or arterial blood; that is, into the state in which it is fitted for being again circulated through all the parts of the body. In man and all warm-blooded animals, this process is constantly going on, and is of such extreme importance in the animal economy, that its interruption for a few minutes may destroy life. This, then, constitutes death from asphyxia; asphyxia being the condition of the body consequent upon the interruption to the arterialization of the blood, and implying the suspension of all the powers of sensation and of voluntary motion. It is only during a certain short period that this state of suspended animation, as it may be called, admits of recovery on the employment of proper means; but if its duration exceed this period, it is irretrievably fatal.

Various are the ways in which respiration, or, rather, the salutary effect of respiration on the blood, may be interrupted. It is obvious, in the first place, that, since the beneficial effect in question is owing to the presence of free oxygen, the deficiency or absence of this element in an uncombined state in the air respired must produce asphyxia. Azotic, hydrogen, or carbonic acid gases, or air too highly rarefied to maintain life, may therefore be ranked among this first class of the causes of asphyxia.

The respiratory organs of warm-blooded animals being adapted to the breathing only of air in its gaseous state, are incompetent to derive the requisite influence from the oxygen contained in water, as takes place in the respiration of fishes. *Submersion* is, therefore, to the former a second cause of asphyxia.

A third set of causes which may induce asphyxia comprise those that operate by preventing the access of air to the interior of the lungs. It comprehends what is properly termed *suffocation*, whether the impediment be wholly external, as when the mouth and nostrils are closed to all ingress of air, or whether it be within the throat, by the introduction of any solid or liquid substance which blocks up the glottis or trachea, or has penetrated into the bronchia, or whether the same effect be the consequence of a disease attended with such tumefaction of the membrane, or accumulation of secretion, so as to close the tube. Analogous to these, and ranking under the same head, is external pressure on the trachea, so great as to prevent the passage of air; an effect usually termed *strangulation*.

A fourth class of causes include those which operate by impeding the mechanical actions that are necessary for the alternate admission and expulsion of air which constitutes breathing. The mechanism of respiration consists in the elevation and depression of the ribs, which is chiefly performed by the intercostal muscles, and also in the descent and ascent of the diaphragm, its own muscular fibres performing the first, and the abdominal muscles being the chief agents in the latter of these actions. If the motions both of the diaphragm and of the ribs be at the same time prevented from taking place, a stop is necessarily put to respiration, and asphyxia must ensue. Such will be the case when a considerable and general pressure is applied externally both to the chest and to the abdomen, preventing their expansion; or, on the other hand, the pressure may be applied internally to the lungs, as when fluid is collected in the cavities of the pleuræ, constituting hydrothorax; or when the same cavities are filled with air, producing what is termed pneumo-thorax. Such will also be the consequence of paralysis affecting the muscles concerned in their actions. The division of the pneumo-gastric, or eighth pair of nerves, on both sides, proves fatal from its impairing the powers of the respiratory muscles. The fatal effects of cold applied extensively to the body have also been explained on the principle of its paralysing influence on the muscles of respiration. But this may admit of doubt.

We should naturally expect that each of these several causes of asphyxia, while it produces that affection with all its general phenomena, will be respectively characterised by certain modifications of effect peculiar to itself, and which may often enable us to distinguish its particular operation. The most perspicuous plan of treating the subject before us will, therefore, be to premise an account of the more general phenomena that universally accompany every form of asphyxia, and proceed, in the second place, to point out such peculiarities attending the different modes by which it may be induced, as appear worthy of remark.

General phenomena of Asphyxia. — The phenomena consequent upon a deficiency of oxygen in the gas which is in contact with the blood in the lungs succeed one another with different degrees of rapidity, according to the greater or less extent of this deficiency, or according as the obstruction to respiration is more or less complete. The effects of a total interruption to breathing are so quickly fatal as scarcely to allow time for accurately observing the order of their succession. This can best be done when asphyxia is gradually induced.

The first perceptible effect of impeded respiration is, a sensation of distress referred to the region of the lungs, accompanied by a strong desire of fresh air, and by an involuntary effort to dilate the chest by throwing into action, not only the intercostal muscles and the diaphragm, but also those muscles which act as auxiliaries in the same office. This sensation rapidly becomes more and more urgent and painful; it rises to one of extreme agony, which agony, however, is but of short duration, being quickly lost in an overpowering torpor, which steals upon the senses, and bereaves the sufferer of every faculty of consciousness. The struggle is, notwithstanding, maintained for a short time longer; being taken up, in the absence of consciousness and volition, by the natural powers inherent in the system, which still survive. It is in this stage of the progress of asphyxia that various irregular and convulsive movements are excited, both in the trunk and limbs, as if the system were instinctively prompted to these efforts in order to burst the spell about to be cast around it. During these commotions, the veins of the head are observed to swell; the face, and particularly the lips, become blue and livid; the eyes are suffused, and seem ready to start from their sockets. At length these involuntary and fruitless agitations subside into quiescence; the powers appear to be exhausted; nature yields to necessity; and a fatal immobility pervades the system. So complete is this general relaxation of the fibres, that even the sphincter muscles, which always retain their irritability to the last moment, at length give way. Yet the heart continues for a time to propel, though feebly, and with quick vibrations, the venous blood it receives from the pulmonary vessels: but, in a few moments longer, a stop is put to its motion, and all circulation is arrested. The asphyxia is now complete; and the critical moment is arrived when life is fast ebbing at its source, and not an instant is to be lost in resorting to the most energetic means for its recall.

It is difficult to assign the precise period at which resuscitation becomes impossible; much will depend upon the mode in which the asphyxia has been produced, upon the age and constitution of the individual, and other circumstances hereafter to be noticed.

Such, then, is the usual course of the phenomena of asphyxia when the abstraction of air has been sudden and complete. When more gradually induced, the sufferings are more protracted; the painful sense of anxiety is accompanied by various feelings referred to the head, such as vertigo, singing in the ears, and scintillations in the field of vision. The extinction of irritability is more gradual, and is not attended with epileptic convulsions. There is also less suffusion of the skin in the face, but a more extensive discoloration over that of other parts of the body, in which red or livid patches often arise.

On inspecting the body after death from simple asphyxia, we find that it presents externally the marks denoting imperfect oxidation of the blood in the capillary vessels of the skin, which accordingly is dark, and, in some places, purple. These livid spots are not unlike those so commonly met with in bodies that have remained for some time in one position after death from other causes. They may in general, however, be easily distinguished from the different situations which they occupy in the body: for the latter description of patches occur in the most depending parts of the skin, and seem to be the effect of the gravitation of the blood in the vessels. This is not the case with the livid spots arising from asphyxia, which appear to have their seat chiefly in the mucous membrane of the skin; for the corion itself is not much affected. A section of the skin in these parts exhibits numerous points where the blood has been congested in the vessels at least, if not extravasated. The joints are generally rigid in a greater degree than in other cases of sudden death. The features of the countenance have an expression of pain; the eyes are distended and prominent, and the pupils dilated.

In the interior of the body the most striking appearance is the great accumulation of blood that has taken place in the pulmonary system of vessels, in the right auricle and ventricle of the heart, and in the great veins which terminate in these cavities; while on the other hand the left auricle and ventricle are comparatively empty. The coronary veins of the heart are rendered remarkably conspicuous by their turgescence; and this is also the state of the principal branches of the vena cava. The liver, spleen, and kidneys are gorged with blood, which may be forced out in large drops by slight compression of the parenchymatous substance of these organs. The blood itself is thick and dark coloured, and is but rarely found coagulated.

The lungs are in a distended state; and, if not restrained by the adhesions they may previously have contracted with the sides of the chest, they often expand so as to meet, and even overlap one another over the pericardium, when the anterior mediastinum is cut through. Their colour is a dark brown; and, like the organs already mentioned, they readily allow, when compressed, of the exudation of the blood they contain. On opening the trachea, we find its mucous membrane deeply injected with blood; and this appearance is still more strongly marked as we trace its progress into the lesser ramifications of the bronchia. The surface of the membrane is frequently overspread with a frothy liquid, slightly tinged with blood. The fibrous tissue which unites the cartilaginous rings of the trachea and bronchia is also injected with blood, and thereby presents a striking contrast to the white colour of the cartilages themselves.

When the previous struggle has been violent, indications are afforded of fulness in the vessels of the head: the sinuses and veins of the brain are distended with blood; and a section of the cerebral substance exhibits an unusual number of red points; an appearance which is often accompanied by the effusion of serum in the ventricles. But in cases where death has been attended with but little disturbance, none of these appearances are met with, and all the vessels of the brain are in their natural state.

The root of the tongue, however, almost always appears as if it had been injected; and its papillæ at this part are remarkably distended. The mucous membrane of the epiglottis and larynx partakes of the affection of that which lines the trachea, and which has been already described.

Theory of Asphyxia. — Very different opinions have been entertained as to the true theory of the phenomena at present under our consideration. Before the chemical effects of respiration on the blood had been discovered, and when the action of the pulmonary organs in promoting the circulation was believed to be altogether mechanical, the cessation of the motion of the heart in hanging or drowning was ascribed to some mechanical impediment to the transmission of blood through the lungs, arresting it in its course, and preventing its access to the left auricle. But the experiments of Goodwyn and others have sufficiently proved that no such mechanical obstruction exists; and that even after the fullest expiration, the air remaining in the air-vesicles of the lungs distends them sufficiently to permit the blood to circulate freely through them. The fact may now be considered as fully established, that the real obstacle arises out of the interruptions to these chemical changes which atmospheric air produces on the blood while circulating in the pulmonary vessels, and which convert it from venous to arterial blood. The blood which in asphyxia thus retains its venous character does, in fact, for a time pass through the pulmonary circulation, and is conveyed into the left ventricle, which propels it through the arterial system. But this blood, which is thus substituted for arterial blood, has deleterious properties: it acts, in fact, as a poison on the organs to which it is sent. The presence of this deleterious agent deprives the organs of the power of performing their respective functions; sensibility, irritability, together with all the physical and vital actions depending upon these powers, are suspended; and their suspension, even for a minute, is fraught with the most imminent danger to life. Dr. Goodwyn, to whom we are indebted for the first consistent hypothesis on this subject, had conceived that venous blood exerts no actually noxious power on the heart itself, *but* that in all cases of obstructed respiration the heart ceases to contract, because the *blood* that passes into it is an insufficient stimulus to its left auricle and ventricle; although, in consequence of a difference in the structure and irritable properties of the two sides of the heart, the same blood was a sufficient stimulus to the right auricle and ventricle.[*] Bichat, however, appears to have satisfactorily established the fact, that the primary effect of the circulation of venous blood is on the brain, and that this effect extends, through the intervention of the brain, to the whole nervous system. The succession of the phenomena of asphyxia plainly demonstrates that loss of sensibility takes place as soon as this venous blood has reached the brain, and exists for some time before the action of the heart is suspended. This effect on the brain is manifestly the source of the convulsions that ensue, and that indicate the strong impression made upon the nervous system. The patient, as it has been strongly but quaintly expressed, dies *poisoned by his own blood.*

The paralysing influence we are describing extends from the brain and nerves to other parts; it affects in particular the capillary vessels of the lungs; the pulmonary circulation is consequently checked; and less and less blood being transmitted through the lungs from the right to the left cavities of the heart, the quantity received by the latter is at length insufficient to maintain their action. The contractions of the heart now cease; its right cavities remaining full, while its left cavities are nearly empty.

The cessation of the action of the heart was accounted for, by Bichat, on the supposition that it was itself paralysed by the deleterious qualities of the venous blood, which, by entering the coronary arteries, penetrated its muscular substance, and destroyed its irritability. If we were to admit this doctrine, however, there would present itself this obvious difficulty in accounting for the renewal of the contractions of that organ on the re-establishment of respiration; namely, that the very power to which it must owe the restoration of its irritability, by the propulsion of fresh arterial blood through the vessels, has, on this hypothesis, been itself destroyed, and therefore the means of recovering it do not exist. Resuscitation from asphyxia would, if this were true, be impossible. But since daily experience shows us that the heart may be made to renew its contractions even some time after they have ceased, we are forced to conclude that that organ still retains, under these circumstances, a considerable share of irritability, ready to be called into action, when a proper stimulus is applied. On the renewal of the action of the pulmonary capillaries, by which means a fresh supply of arterial blood is poured into the left auricle and ventricle, these cavities are urged by their appropriate stimulus, which is that of mechanical distension, again to contract and renew the circulation. Arterial blood being thus again diffused over the system, imparts its vivifying influence to all the organs; their suspended functions are resumed, and animation is restored.

In confirmation of the views here given, we may cite the experiments of Dr. Kay,[*] and also those of Dr. Edwards,[†] which tend to prove that when venous blood is made to circulate through the substance of muscles, it contributes to support their irritability in a certain degree, although less effectually than arterial blood. Admitting, then, that the heart retains a certain portion of irritability, sufficient to account for the renewal of its contractions under certain circumstances, it would appear that the causes of the cessation of its action may be resolved partly into a deficiency of supply of blood to the left ventricle, consequent upon the paralysis of the capillaries of the lungs, which deprives them of the power of propelling it forwards; partly into its own diminished irritability, arising from the direct effect of the entrance of venous blood into the coronary arteries; and partly also into the participation of the heart with the general deleterious impression made on the whole nervous system, by the circulation of venous blood in the brain and other parts of the system. So intimately are all the vital functions connected together, that it is extremely difficult to assign to each of these causes the real share which it respectively has in the production of the whole of the observed effect. There can be little doubt that any one of them would of itself be sufficient to arrest the movements of the whole machine; and that the derangement of any one of the functions which are here implicated, would necessarily throw all the rest into disorder, and destroy the equilibrium of the system. The first, in point of time, in the series of phenomena consequent upon the suspension of the arterializing process, is the affection of the brain. Were this the sole effect directly produced by the want of oxygen, or superabundance of carbon in the blood, then might asphyxia be ranged under the head of apoplexy; and the subsequent failure of the circulation would be a consequence of the impaired energy of the nervous powers which maintain the energy of the heart. But this can scarcely be admitted to be the sole cause of death; because the motion of the heart in asphyxia is arrested much sooner than it ever is in simple apoplexy. We find, indeed, that in the latter disease the heart continues to beat for many hours, or even days, after the destruction of the faculties of sensation and of consciousness; and it appears at length to stop principally in consequence of the cessation of breathing, which always takes place when the abolition of the powers of voluntary motion has proceeded a certain length. So that, in fact, it may more properly be said that apoplexy proves fatal by inducing a state of asphyxia, than that asphyxia is merely a species of apoplexy, as it has been erroneously classed in some systems of nosology.

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[*] See his work entitled, "The Connexion of Life with Respiration." London, 1788, p. 82, 83.

[*] See Edinburgh Medical and Surgical Journal, vol. xxix. pp. 42 and 46, [and The Physiology, Pathology, and Treatment of Asphyxia. Lond. 1834.]

[†] De l'Influence des Agens Physiques sur la Vie. Part i. ch. i. and part iv. ch. iv.

The chief seat of the stagnation of the blood in asphyxia is the minute pulmonary vessels; and this may be inferred from the fact that the whole of that part of the vascular system, and apparatus connected with it, which precedes it in the order of circulation, is distended with blood. Such, we have seen, is the condition in which the pulmonary arteries, the right ventricle and auricle of the heart, the venæ cavæ, and all their branches, are found after death. On the other hand, those portions of the vascular apparatus which follow this point in the order of circulation, are nearly empty of blood; namely, the left auricle and ventricle, the aorta, and all its branches and ramifications. The inquiry into the condition of the pulmonary capillary vessels, which this stagnation of the blood in them implies, would open a wide field of discussion; for it would involve the disputed question of the nature of the action of the capillaries, the power they possess to propel their contents, and the extent in which they contribute to carry on the circulation. Without entering into this discussion, for which this is not the proper place, it will be sufficient to state that, by the expression of *paralysis of the capillaries of the lungs*, we have merely meant to denote that condition which renders them incapable of transmitting onwards the blood which is sent to them. It might certainly be expected that, on the interruption to the chemical changes which the blood usually undergoes in the lungs, these vessels would be the first to suffer from any noxious property which the blood might thereby acquire; since they are more intimately in contact with it, and more extensively exposed to its action. While we admit, however, that this affection of the pulmonary capillaries is one of the principal causes of the cessation of the heart's action, it is at the same time very probable that the diminution of its energy, occasioned by the circulation of venous blood through its substance, contributes in a great degree to the same effect. It is of great importance, in a practical point of view, to obtain a true theory of asphyxia; since the success of the measures we may adopt for the purpose of restoring suspended animation will depend on its correctness.

[Experiments have been since instituted, which do not accord in all respects with those of Dr. Kay. Dr. Reid concludes, that the suspension of the functions of the encephalon is chiefly, if not entirely dependent upon the circulation of venous blood in the arteries. He does not, however, maintain, that venous blood exerts any noxious influence upon the functions of the nervous texture, but believes, that the effects are solely attributable to the want of the proper excitation of the organ; for, when the circulation of arterial blood is renewed, its functions rapidly manifest themselves, provided this be done within a given time. He believes, that the order of succession in which the vital processes are arrested in asphyxia is as follows:—The venous blood is at first transmitted freely through the lungs, and reaches the left side of the heart, by which it is driven through all the textures of the body. As the blood becomes more venous, its circulation through the vessels of the brain deranges the sensorial functions, and rapidly suspends them, so that the individual becomes unconscious of all external impressions. The functions of the medulla oblongata are enfeebled about the same time that the sensorial functions are arrested, but are not fairly suspended for some time longer. Immediately after the sensorial functions are suspended, and the blood has become still more venous, it is transmitted with difficulty through the capillaries of the lungs, and, consequently, begins to collect in the right side of the heart. A smaller quantity of blood must now necessarily reach the left side of the heart; and the diminution of the quantity of blood sent along the arteries, conjoined with its venous character, and the ultimate arrest of the circulation, being sometimes incompatible with the manifestation of vitality in the other tissues of the body, general death is sooner or later induced. This view consequently ascribes the phenomena of asphyxia chiefly to the circulation of blood that has not been oxygenated in the lungs, or, in other words, of blood devoid of the proper excitant agency, and subsequently to arrest of the blood in the capillaries of the lungs, which occasions the flow of arterial blood towards the left heart to be arrested. As a consequence of the want of the stimulus of distension, the left cavities lose their contractility;—the right auricle, which continues for a time to receive blood by the venæ cavæ, being the *ultimum moriens*. The nervous, muscular, parenchymatous and other tissues, no longer receiving a supply of arterial blood, cease, also, to act; but those organic functions, which are effected in the capillaries of the general system, as nutrition, secretion and calorification, yield last; circulation continuing in the capillaries for some time after it has ceased in the larger vessels.]

PARTICULAR KINDS OF ASPHYXIA.—The first class of causes producing asphyxia we have stated to be the deficiency of oxygen in the air respired. These may again be divided into three heads.

First, Excessive rarefaction of the air. Animals have often, for the sake of experiment, been destroyed by being placed under the receiver of an air-pump; and if the process has not been too long continued, the mere re-admission of air is generally sufficient to restore life. The phenomena they exhibit under these circumstances do not appear to differ, in any notable manner, from those which animals of the same kind present when suddenly plunged into an atmosphere of gas of the ordinary density containing no oxygen. With regard to the human body, the only way in which it is ever probable that death can arise from the excessive rarefaction of the atmosphere, is in the case of ascent to very elevated regions, as on the summits of mountains or in balloons. But, although the muscular strength is found to be much enfeebled under these circumstances, it appears never to amount to a degree that is dangerous to life.

Secondly, The respiration of gases, which, although they contain no oxygen, appear of themselves to have no positively injurious operation on the system. To this class belong hydrogen and azotic gases. It is found, accordingly, that the voluntary endeavour to respire these gases for a short time is unattended with danger. This has been proved very satisfactorily by the experiments of Sir Humphry Davy, and many others. The deviations from this general result, which have been observed by some experimentalists, may readily be accounted for by impurities in the gas, and more particularly by the admixture of carbonic acid gas. In this way we may explain the observation of Sir Humphry Davy, who reports that he experienced a greater sense of suffocation from respiring azotic than hydrogen gas. The phenomena exhibited by animals confined in either of these gases are those of simple asphyxia.

Thirdly, The respiration of gases having positively deleterious effects upon the system. To this head may be referred carbonic acid and carburetted hydrogen gases, which produce no visible changes on the animal textures; and also various other gases, which exert an immediate destructive chemical action on the parts with which they come in contact: of this latter kind are chlorine, sulphureous, and nitric acid gases, ammoniacal gas, &c.

Asphyxia from the respiration of carbonic acid gas.—The instances of persons losing their lives from respiring air charged with carbonic acid gas, are very frequent. The diffusion of this gas through a large mass of air is exhibited on a great scale in mines, where it is known by the name of the *choke damp*. From its greater specific gravity, compared with that of common air, it is always found in the lowest parts of the mine, and is on that account dislodged with great difficulty. In volcanic districts, streams of carbonic acid are often known to issue in considerable quantities from fissures in rocks; a remarkable instance of which occurs in the celebrated Grotto del Cane, in the neighbourhood of Naples; being so named because dogs are kept near the spot, for the purpose of exhibiting to travellers the effects of this air upon these animals. Their heads are held in the gas, which only rises to a certain level in the grotto, till asphyxia is induced; from which state they generally soon recover, after being removed into pure air and plunged into water. The same gas is sometimes found to occupy the bottoms of wells or vaults; especially if they have been allowed to remain for a long time unopened. Large vessels, where the vinous fermentation has been carried on, such as brewers' vats, become often filled with carbonic acid, rendering it highly dangerous for persons to descend into them without having previously ascertained the respirability of the air they contain. This may always be done by letting down slowly a lighted candle. If the candle continues to burn, the air that surrounds it is capable of maintaining life; and the place at which the candle goes out will show the height to which the foul air reaches.

The vapour of burning charcoal, which is formed by the combination of its carbon with the oxygen of the atmosphere, consists chiefly of carbonic acid gas, together with a certain small proportion of carburetted hydrogen, depending upon the presence of moisture in the charcoal. This vapour has often been the cause of suffocation to those who have been exposed to its influence. It has often happened that persons have gone to bed in a close room in which a charcoal fire was kept up through the whole of the night, and have been found dead in the morning. The same fatal effects have resulted from breathing the air of a lime-kiln, by persons who have approached too near; or who, having fallen asleep on the side of the kiln, have had the fumes which issued from it blown upon them in consequence of a change of wind.

The effects of the respiration of carbonic acid gas are somewhat different according as it is in a concentrated or diluted state. If an attempt be made to breathe it in its pure or undiluted state, it is found to make so powerful an impression on the throat as immediately to excite a spasmodic contraction of the glottis, which remains completely closed, so that no portion of the gas can be made to enter into the bronchi, in spite of every effort of volition. Sir Humphry Davy introduced into a silk bag four quarts of well-washed carbonic acid in a state of great purity, and after a complete voluntary exhaustion of his lungs attempted to inspire it. It communicated a strong acid taste to the mouth and fauces, and a sense of burning at the top of the uvula. It was in vain that he made the most powerful voluntary efforts to draw it into the trachea: at the moment that the epiglottis was raised a little, a painful stimulation was induced, so as to close it spasmodically over the glottis; and the same thing happened in repeated trials. (Researches concerning Nitrous Oxide, &c. p. 472.) A similar trial of the effects of breathing this gas had been long ago made by Pilatre de Rozier, (Journal de Physique, xxxviii. p. 418,) who, for the purpose, went into a brewer's tub while it was full of carbonic acid evolved by fermentation. His first sensation was increased heat and perspiration, attended with itching, especially in the eyes. Whenever he attempted to breathe, he was prevented by a violent feeling of suffocation. He sought for the steps to get out, but as he was doing so, the necessity for breathing increased, he became giddy, and felt a tingling sensation in his ears. As soon as his mouth reached the air he breathed freely, but for some time could not distinguish objects; his face was purple, his limbs were weak, and he understood with difficulty what was said to him. He soon recovered, however, from this state. This experiment was often repeated; and he always found, that as long as he remained without attempting to draw his breath, he could move without inconvenience; but every attempt to breathe instantly brought on the feeling of suffocation.

Persons exposed by accident to the influence of an atmosphere of this kind seldom escape the danger in which it places them. It is not uncommon, for example, to hear of a person descending into a brewer's vat or into a vault, containing a stratum of carbonic acid up to a certain height, and falling down in an instant, as if shot, without the slightest struggle. Another person going to his assistance, and, of course, warned by his example, prepares himself to resist the fatal influence of the gas; yet with every precaution he can take, and with every provision for being pulled up by assistants by means of ropes, we will suppose, tied round him for that purpose, he also is seen suddenly to drop, without his even being able to make the preconcerted signal. A third person descends and undergoes the same fate. It has thus often happened that several persons in succession have fallen victims to their humanity in endeavouring to rescue others from so perilous a situation.

These facts seem to prove, in the most unequivocal manner, the positively deleterious properties of this gas, which produces a sudden abolition of all the animal functions, without even being applied to any considerable extent of the internal pulmonary surface. The immediate symptoms which it excites are, sensations referred to the head, pain, giddiness, a feeling of debility, which mark the strong impression that is made on the sensorium; and the whole nervous system is doubtless in like manner powerfully affected. It has been alleged also that the muscles of animals destroyed by immersion in irrespirable gases, lose more of their irritability than happens with those which have been hanged or drowned.

The symptoms produced by the continued respiration of carbonic acid gas mixed with atmospheric air, partake much of the character of apoplexy. We may still observe that the primary effects appear to be produced upon the brain. Headach, vertigo, slight nausea, heaviness, and irresistible inclination to sleep, mark the first stages of this affection. The patient passes from sleep to coma, from which it is impossible to arouse him; the pupils become dilated, the respiration stertorous. The countenance is flushed, the lips are livid; the pulse is often full and strong. There is no gasping for breath, no painful struggle, no unutterable anxiety, no convulsion. The transition from life to death is calm and tranquil, and the functions and powers of the system are one by one extinguished, as if in obedience to the resistless spell of some potent enchanter. Such was the mode of death chosen by the younger Berthollet when bent upon suicide. He shut himself up in a small closet by the side of a chafing-dish of burning charcoal, carefully closing every aperture through which the poisonous fumes could escape; and quietly sate himself down to register the successive feelings as they arose. They were such as attend the operation of a narcotic. The description of them which he had written had evidently been interrupted by a pause; then followed an almost illegible word; the pen must then have dropped from his hand; he probably never stirred afterwards.

The particulars of two interesting cases of exposure to the vapour of burning charcoal, with the details of the treatment adopted, are given by Dr. Babington in the first volume of the Medico-Chirurgical Transactions (p. 83); and they are rendered highly instructive by the judicious reflections which accompany the narrative. He observes that the fatality of this gas to the different classes of animals is, in general, in proportion to the more complicated system of their organization. On the human constitution, according to the period of exposure, and the degree of concentration, its effects vary through all the shades of giddiness, pain of the head, anxiety, depression of the powers of life, impeded respiration, loss of voluntary motion and sensation, to the complete suspension of respiration and circulation.

The power of resistance to this narcotic agency appears to be less in youth than in a more mature age. The two persons above mentioned, the one a man thirty-eight years of age, and the other a boy of thirteen, had gone to bed in a room in which a chafing-dish of burning charcoal had been placed at the foot of the bedstead. In the morning the boy was found completely dead, having apparently gone off without a struggle; but the man was in an apoplectic state, and by the employment of proper means eventually recovered. A parallel case is related by Bourdon, (Principes de Physiologie Médicale, partie ii. p. 650,) of a woman, thirty-five years of age, who, being reduced to a state of desperation by jealousy and misfortunes, had taken the resolution to destroy her own life together with that of her daughter, a girl of five years of age. Having shut herself up with her child in a closet with a large brasier of burning charcoal, the bodies were, some time after, found extended on the floor. The mother was recovered without much difficulty; but none of the means that were tried could elicit from the child the smallest sign of life.

Asphyxia from carburetted hydrogen gas.—The respiration of carburetted hydrogen gas is peculiarly fatal to life, appearing to act as a direct sedative, immediately destroying the vital powers. A bold attempt was at one time made by Sir Humphry Davy to breathe this gas in its undiluted state: he took three inspirations, which very nearly killed him; (see his Researches concerning Nitrous Oxide, p. 468.) Even when mixed with common air, it has a singularly depressing influence upon the powers of life. The extensive introduction of this gas, within these few years, for the purpose of lighting the streets and public buildings, is likely to lead to the frequent occurrence of accidents of this nature.

Gases of a more compound nature, and still more deleterious properties, are often emitted in great abundance from putrefying animal and vegetable substances, and especially from privies, sewers, and burying-grounds. A striking account of the remarkable effects produced by the exhalations from opening graves has been given by Fourcroy. It appears, from the report of the grave-diggers who were examined on the occasion referred to, that those men who happened to be standing immediately over a corpse, of which the abdomen was suddenly struck into by a pickaxe, often fell down, on a sudden, in a state of apparent death; while those who were at a greater distance, and received the noxious effluvia in a more diluted state, were attacked with nausea, giddiness, tremors, and faintness, which symptoms continued for some hours.

Asphyxia from Drowning.—In our classification of the causes of asphyxia, *submersion* or *drowning* forms the second head.

The general account we have already given of the symptoms and progress of asphyxia in its simpler forms, supersedes the necessity of entering into a detail of all the phenomena attending asphyxia from submersion, and it will only be requisite to notice those that are peculiar to this mode of inducing the affection.

The symptoms and appearances met with in drowning vary considerably, according to the state of the individual at the time of submersion, to his ability to make efforts to save himself, to accidents that may happen to him after falling into the water, to the depth and the temperature of the water, and other circumstances.

Let us first take the simplest and most ordinary case of a healthy individual, in perfect possession of his faculties, falling into the water from a certain height, and descending, from the impetus given by the fall, to some depth below the surface. He quickly rises again to the surface of the fluid, buoyed up by difference in specific gravity between his body and the water, and also frequently receiving additional support from air entangled in his clothes. If able to swim, he supports himself at the surface as long as his strength lasts him; when that fails, he is in the situation of a person who is unable to swim; in either case he then performs movements at random with his arms and legs, and, while sinking to the bottom of the water, involuntarily grasps any object that comes within the reach of his hands. From the irregularity with which these actions are performed, he appears at the surface, and again disappears, several times successively. Whenever the mouth happens to be out of the water a hasty gasp is made, by which water as well as air goes down the throat, and, exciting cough, is partly expelled from the trachea; but, by the same effort, the air that had been taken in at the same time is also rejected. This creates a fresh demand for air; and, as soon as an opportunity occurs, another and more hurried attempt is made to satisfy it. This very eagerness tends but to defeat its own object; for if the head be only half raised above the surface, the chance is that water is again taken in by the effort to inspire. It is again rejected by the spasm of the glottis, and the consequent convulsive action of the muscles of the throat; and in the painful conflict of the two contending elements some water is swallowed, and passes into the stomach. All these violent efforts tend to determine blood to the head; and that blood, partaking of the venous qualities, puts an immediate stop to the functions of the brain. Sensation and voluntary motion cease; the body sinks motionless to the bottom of the water, the pressure of which on the sides of the chest finally expels a portion of the air that still remained in the lungs when the last effort was made.

The account of these phenomena, given by Dr. Goodwyn, is so clear and concise that we shall give it in his own words:—"When an animal," says that author, (Connexion of Life with Respiration, p. 3,) "is immersed in water, his pulse becomes weak and frequent; he feels an anxiety about his breast, and struggles to relieve it; in these struggles he rises towards the surface of the water, and throws out a quantity of air from his lungs. After this, his anxiety increases; his pulse becomes weaker; the struggles are renewed with more violence; he rises towards the surface again, throws out more air from his lungs, and makes several efforts to inspire; and in some of these efforts a quantity of water commonly passes into his mouth. His skin then becomes blue, particularly about the face and lips; his pulse gradually ceases; the sphincters are relaxed; he falls down without sensation and without motion."

The following is the account given by the same author of the appearances that present themselves if the body be immediately opened.

1. The external surface of the brain is of a darker colour than usual; but the vessels are not turgid with blood, nor are there any marks of extravasation about them.

2. The cavity of the lungs contains a considerable quantity of frothy fluid; and the pulmonary arteries and veins are filled with black blood throughout their whole extent.

3. The right auricle and ventricle of the heart are still contracting and dilating; the left sinus venosus and auricle move feebly; but the left ventricle is at rest.

4. The right auricle and ventricle are filled with black blood, and the left sinus venosus and left auricle also; but the left ventricle is only about half filled with the same coloured blood.

5. The trunks and smaller branches of the arteries proceeding from the left ventricle also contain a quantity of this black blood.

To this description we may add the following particulars. The face is in general pale, though slightly livid; the mouth contains a good deal of frothy fluid; the tongue is often protruded between the teeth. The same frothy liquid is found in the trachea, bronchia, and air-cells of its lungs, as also some water, the quantity of which varies much in different instances. The lungs are of a violet hue, and the blood they contain is fluid, but less in quantity than in cases of asphyxia from carbonic acid gas. The left ventricle of the heart is never completely empty; the quantity of blood found in it being generally about half that contained in the right ventricle, (*Coleman* on Suspended Respiration, p. 248.) Some blood is also found in the aorta. In the stomach there is almost always found some portion of the fluid in which the person was drowned, and the quantity is sometimes considerable. The vessels of the brain do not exhibit any particular appearance of distension.* The air contained in the lungs has nearly lost the whole of its oxygen. This was the uniform result of a great number of experiments made by Dr. Berger, of Geneva, on the air that was expelled from the lungs a short time after immersion.†

Great discordance exists in the representations of different authors as to the quantity of water found in the lungs and stomach of drowned men and animals, and its influence on the destruction of life. De Haen was of opinion that death is occasioned by water flowing into the lungs, and stopping the passage of the blood in the vessels. Dr. Cullen stated, from the result of many dissections, that there is often no water found in those situations; and never any quantity likely to injure the organization of these parts, (Letter to Lord Cathcart.) Dr. Goodwyn's investigation of this subject is exceedingly satisfactory, and seems to have laid this question entirely at rest. By drowning animals in a coloured liquid, such as ink, he ascertained that the quantity of fluid that really entered the body was infinitely less than was adequate to produce death. He drowned other animals in quicksilver, which, from its not mixing with the animal fluids, could be more easily collected, and its quantity determined. He thus ascertained that only five drachms of the fluid in which a cat was immersed entered its lungs while drowning; and in order to determine whether or not this could occasion the death of the animal, he made the following experiment: having confined a cat in an erect posture, he made a small opening in its trachea, and introduced through it two ounces of water into its lungs. The only effects it produced were a temporary difficulty of breathing and weak pulse; but these symptoms soon subsided, and the animal lived several hours afterwards without experiencing any further inconvenience. At the end of this time it was strangled, and two ounces and a half of water were found in the lungs. Similar experiments were made with other fluids, and with nearly the same result. Hence Dr. Goodwyn concluded that, in drowning, a small quantity of water does usually pass into the lungs; that it enters during the efforts to inspire, and, mixing with the pulmonary mucus, forms a frothy fluid; but that the whole of this fluid is insufficient to produce the changes that take place in drowning, (Connexion, &c., p. 19.) The experiments of Dr. Goodwyn on these points have been since confirmed by Mr. Kite and Mr. Coleman. Professor Meyer has also investigated the same question by employing water in which hydrocyanate of potash had been dissolved, and testing the fluid found in the lungs with the muriate of iron, (Medical Repository, vol. iii. New Series, p. 436.)

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* Observations on Apparent Death from Drowning, &c. By James *Curry*, M. D.

† Essai Physiologique sur la Cause de l'Asphyxie par Submersion. Par J. F. *Berger*, de Genève, 1805.

We have hitherto supposed the person to retain his self-possession during the first moments of his finding himself in danger of drowning: but it may happen that he was intoxicated at the time he fell into the water; or else the sudden impression of cold, or the surprise and shock may have overpowered his faculties, and may have occasioned immediate syncope. It may also happen that in the fall his head has struck against some hard body, and he may be stunned by the blow. In all these cases, there is no struggle whatever; the body at once sinks passively to the bottom, never more to rise. Here it is evident that all the effects already described as the result of a struggle will not take place; and the only appearances observed after death will be those of simple asphyxia. Paleness will be seen in the face as well as in the rest of the body; the trachea will merely contain a little water, but no froth; the lungs will be but little distended, and will preserve their natural colour; and there will be no great inequality in the comparative quantities of blood contained in the arteries and the veins; and no fluid will be found in the stomach, but what was contained in it at the time of submersion.

We may also suppose other instances in which this sudden syncope, or abolition of the cerebral faculties, may occur after a momentary struggle; in which cases the phenomena already described will have been in part produced, and the further changes prevented from taking place. All these considerations are of great importance in their relation to many questions of medical jurisprudence.

The great diversity that may take place in these and other circumstances will enable us, perhaps, to explain the differences that are met with in the time during which the body may remain under water, compatibly with the possibility of restoring life. If the submersion have not exceeded *five minutes*, and no blow against a stone, or other violence has occurred to complicate the effects, our efforts at resuscitation, if properly conducted, will generally be successful. After a quarter of an hour, recovery is not very common; after twenty minutes, or half an hour, it may be considered as hopeless. The longest period recorded in the Reports of the Humane Society is three quarters of an hour. On the other hand, some, who have only been a few minutes under water, cannot be restored to life even by the prompt application of the proper means.

It appears from the first report of the establishment for the recovery of drowned persons at Paris, that out of twenty-three cases restored to life, one had been three quarters of an hour under water, four had been half an hour, and three a quarter of an hour; the rest being for a much shorter time.*

The habit of being under water, as in the case of professed divers, may enable a person to remain in that situation longer than he otherwise would be able to do; but its power will not go far. The Indian divers employed in the pearl-fishery are said to be capable of remaining three, four, and in some cases even five minutes without injury. (See *Percival's* History of Ceylon.) The numerous cases on record in which it is alleged that life has been restored after being several hours under water are totally unworthy of credit.

Asphyxia from strangulation.—The third division of the causes of asphyxia comprehends all those that prevent the access of air to the lungs, whether by suffocation or strangulation. The most common of these is a ligature round the neck, as in the case of *hanging*.

Considerable variety is observed in the length of time during which vitality continues while criminals are suspended from the gallows; the differences depending, in a great measure, on the mode in which the rope is adjusted round the neck, the height and suddenness of the fall, and other circumstances of violence attending the execution. Much also will depend on the peculiar constitution and previous bodily condition of the individual. Convulsions of an epileptic character very generally supervene on the loss of sensibility, which, if the closing of the trachea be complete, as it generally is in consequence of the strong pressure of the rope, very speedily follows the exclusion of air. The face is always turgid, and suffused with livid blood. This swelling and turgescence extend also to the shoulders, arms, hands, and chest, which are of a livid hue. The eyes are generally open, and projecting, and the vessels of the conjunctiva distended with blood. The tongue is frequently thrust out of the mouth, and wounded by the convulsive action of the jaws; and a bloody mucus issues, in consequence, from the mouth.

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* Détail des succés de l'établissement que la Ville de Paris a faite en faveur des personnes noyées. Paris, 1773, quoted by Dr. Good.

The distortion of the features, and other marks of strong muscular action, are evidently consequences of the violent struggles of the sufferer, and are proportional to the irritation excited in the brain. The muscles which raise the shoulders, and assist the muscles of inspiration, are strongly contracted. The other muscles of voluntary motion, instead of being rigid, are more relaxed than usual; so that the limbs exhibit more flaccidity than in cases of tranquil death. The mark of the cord will always be evident round the neck, forming, when the person has been hanged up alive, a livid depressed circle. Frequently we find patches of ecchymosis on the surface of the upper part of the trunk and superior extremities. The fingers are bent, the nails blue, and the hands firmly clenched. From the relaxation of the sphincters, the urine and fæces are often involuntarily expelled. Erection of the penis and emission of semen also frequently take place from hanging.

It is evident, from all these circumstances, that the struggle is usually more intense in this mode of death than in drowning. This happens more especially when, from the inaccurate adjustment of the rope, from rigidity of the cartilages of the larynx, or from any other cause, the trachea is imperfectly closed: for, in that case, a small current of air may still pass, and, though insufficient to support life, may contribute to prolong the sufferings and struggles of the victim. This is often observed in those who voluntarily hang themselves, and who frequently suffer much before they die, in consequence of their inexpert mode of executing their purpose; and in whom we consequently find the cheeks, lips, eyes, and tongue particularly swollen and prominent. In the same proportion as we meet with these indications of a more protracted death, we find the lungs less gorged with blood, and the blood about the heart more equally distributed among its cavities and great vessels. For, in consequence of the admission of even a small portion of air into the lungs, the heart is enabled to keep up the circulation for a longer time, and is only more gradually overpowered; while, at the same time, the pressure of the rope on the jugular veins in the neck obstructs the return of the blood from the head, accumulates it in the vessels of the face, and gives rise to the appearances of apoplexy.

But wherever the obstruction of the trachea has been complete, there is no evidence that death by hanging is the consequence of apoplexy: and, in fact, when the executioner is sufficiently expert in his task, death is too suddenly induced to admit of an accumulation of blood sufficient for producing apoplexy. De Haen ascertained, from numerous experiments on dogs, which he hanged and opened as soon as they were dead, that no marks of apoplexy were to be found in the brain.

The following experiment, performed many years ago by Dr. Monro, Senior, of Edinburgh, proves incontestably that the immediate cause of death in hanging is the exclusion of air from the lungs. A dog was suspended by the neck with a cord, an opening having previously been made in the trachea below the place where the cord was applied, so that air could pass into the lungs as freely as in ordinary respiration. After hanging in this state for three quarters of an hour, during which time the circulation and the breathing went on as usual, he was taken down, and appeared not to have suffered materially from the operation. The cord was then shifted from above to below the opening made into the trachea, so as totally to prevent the ingress of air into the lungs; and the animal being again suspended, was in a few minutes completely dead. (*Curry*, Observations, &c. p. 71.)

It is very probable, however, that the degree of obstruction to the circulation occasioned by a tight ligature on the neck, which presses upon the jugular veins, has a considerable share in hastening the period at which death would take place were it dependent on the mere interruption to breathing: so that, from this double cause, the punishment by hanging, if dexterously executed, is probably unattended with much pain. By the violent means often employed in the execution of criminals in this country, it may, indeed, happen that another and more suddenly fatal injury is produced, namely a dislocation or fracture of the cervical vertebræ. We have reason to believe, however, upon good authority, that such accidents are rare, even when on a public scaffold a hardened criminal leaps from the gallows to obtain a quick termination to life; and it can hardly ever occur in cases of suicide. It is evident that, were any fracture or luxation of the vertebræ of the neck to take place, immediate death would ensue, and would preclude all possibility of recovery, however promptly assistance might be afterwards afforded; whereas instances have been recorded of victims to the law having been recovered by inflating the lungs after the body had been cut down.

Dr. Plott, in his Natural History of Staffordshire, (page 292,) relates that in the reign of Henry VI. a woman of the name of Snetta de Balsham, after having been hanged according to the sentence of the law, and cut down after being suspended a whole night, was found to be still alive; in consequence of which extraordinary escape she was pardoned by the king. But it appears, from Dr. Plott's account, that she owed her preservation to an ossification of the larynx, which kept open a passage for the air. Attempts have often been made to defeat the object of the punishment by introducing a silver canula into the trachea, previous to the execution; but the intolerable irritation excited in so sensible a part as the glottis by the presence of an extraneous body, must ever preclude all hope of success from such a project. If the method practised in Dr. Monro's experiment on a dog, were adopted in the case of a person intended for execution, it might certainly be attended with a successful result. It is recorded, indeed, that an expedient of this kind was actually tried in a remarkable case, the particulars of which are given by Dr. Mahon. (Médecine Legale et Police Médicale, tom. iii. p. 62.) A butcher, of the name of Gordon, was condemned to execution, at the Old Bailey, for highway robbery, in the beginning of the last century. Having amassed great riches by his successful career of crime, he persuaded a young surgeon, by the hope of a great reward, to attempt to save his life. The surgeon proposed the plan of making an opening low down in the trachea, and introducing through it a small canula. This was secretly accomplished previous to the execution; the blood that was effused in consequence excited some suspicion, but being attributed to a desperate attempt at suicide, the circumstance only occasioned the hastening of the hour of his execution. After the body had hung the usual time, it was taken down, consigned to the relations, and quickly removed to a neighbouring house, where the surgeon was anxiously waiting to receive it. He immediately drew some blood from the jugular vein, and enforced every means calculated to restore animation. Gordon opened his eyes, heaved a deep sigh, but expired a few minutes after. The failure of success was attributed to the great weight of the body, which increased the violence done to the parts compressed by the rope.

The appearances presented on opening the bodies of persons who have been hanged, besides the local marks from the pressure of the cord, are exceedingly similar to those produced by drowning, and of which we have already given a sufficiently detailed account. The right cavities of the heart, and the pulmonary vessels, are full of blood; the left cavities and the arteries very nearly empty. The principal difference, however, is in the state of the lungs, which are found remarkably distended with air, so that they do not readily collapse when the thorax is opened. There is, of course, no water found in the bronchia or air-cells, as often happens after submersion. Dr. Goodwyn ascertained that the lungs of two persons of ordinary stature, who had died from hanging, contained in the one case two hundred and fifty, and in the other two hundred and sixty-two cubic inches of air; whereas the lungs of those who die a natural death contained only from ninety to one hundred and twenty-five cubic inches, (*Goodwyn*, Connexion, &c. sect. iii. p. 25, 26,) or, taking the mean of four experiments, one hundred and nine cubic inches. The reason of this difference is obvious: persons about to be hanged are under the influence of fear, and will therefore naturally make a deep inspiration before the cord is tightened on the neck; and the pressure of the cord on the trachea, when the body is suspended, becomes immediately so great, that the air cannot again be expelled. The absence of this obstruction in the case of persons who are suffocated in other ways, such as by the application of a pillow to the face, will account for the difference in this respect in the appearances after death. These appearances, when death has been produced under the circumstances just alluded to, approach more nearly to those of simple asphyxia, with the addition, however, of traces of the violence that has been done to the victim in the completion of the murderous design. It is possible, for example, that the murdered victim may have been first strangled, and afterwards suspended. If, therefore, we should perceive, on a person found hanging, that there are two distinct circles formed by a cord; or deep impressions of fingers on the throat; and if, at the same time, the clothes are torn, the hair dishevelled, or other indications of resistance are observed, we may fairly presume that violence has been committed by another, and that it is not a case of suicide. All indications of this kind become the subject of serious investigation in any legal inquiry implicating the guilt of parties accused of such crime; but as they constitute an important topic of medical jurisprudence, we shall pass them over as being foreign to the purpose of this article.

Among the causes which induce asphyxia may be enumerated the introduction of foreign bodies into the larynx or trachea; such accidents are not unfrequent, and produce various degrees of impediment to respiration, according to the bulk, shape, and situation of the extraneous body. Even if they do not immediately prevent the ingress of air, they excite by their presence such violent irritation and spasmodic action, as are soon followed by a high degree of active inflammation, which, producing a swelling of the membranes, contributes still further to contract the passage, and induce asphyxia. The nature and succession of the symptoms will, of course, be very similar to those of strangulation; but the sufferings are more protracted, the anguish is extreme, and the extinction of the powers of life more gradual. A person may even live for some days, if the trachea be only partially obstructed: if the obstruction is complete, he loses all sensation in a few minutes, and soon after expires. The Greek poet Anacreon is said to have lost his life in the eighty-fifth year of his age, from a grape-stone which stuck in his throat while luxuriously quaffing some new wine.

Suffocation sometimes follows the bursting of an abscess which has been formed in the tonsils, and suddenly poured its contents into the larynx. Croup occasionally proves fatal by the mechanical obstruction which is created by the adventitious membrane that is formed in that disease.

Asphyxia is sometimes the result of pressure applied to the body in so general a manner as to impede not only the motion of the ribs, but also that of the diaphragm. This will happen, for example, to a miner, buried completely under a mass of earth that has fallen upon him. Death will in that case be induced with greater rapidity than from most other causes of asphyxia; because the pressure will force out nearly the whole of the air contained in the chest, and preclude any further movement of dilatation or contraction of its sides. The circulation is quickly arrested, and no opportunity is afforded for the accumulation of blood in the venous system. The body, accordingly, will present no discoloration of the skin, no turgescence of the veins, no engorgement of the pulmonary vessels. We have here, it is true, represented what will happen in an extreme case. Modifications will obviously arise, corresponding to the peculiarity of circumstances existing in each particular instance, and into the detail of which the exposition of these general principles renders it unnecessary to enter. We shall mention only one remarkable instance, in which a person was in great danger of losing his life from inattention to the physiological conditions requisite for respiration. An athletic black, of pugilistic celebrity, had been selected, from the fine form of his chest, and well-marked expression of his muscles, as an academic model. It was wished to obtain a cast of his body; but this being attempted at one operation, and in one entire piece, as soon as the plaster began to set, he felt on a sudden deprived of the power of respiration, and, to add to his misfortune, was cut off from the means of expressing his distress. His situation, however, was fortunately perceived just in time to save his life, by breaking his bonds and releasing him from the extreme peril in which they had placed him.

The consideration of the effects of the admission of air, or of collections of fluid in the thoracic cavities compressing the lungs, as also the consequences of injuries to the spine above the origin of the phrenic nerves, or a paralysis of those nerves from any other cause, in producing asphyxia, will fall more properly under other heads.

General treatment of Asphyxia.—Although the suspension of all the vital actions of the system which takes place in asphyxia has originated from the temporary interruption in a single function, yet the derangement which has followed is of so complicated a nature, and extends to so great a number of important organs, that the mere re-establishment of the function primarily disturbed is not immediately followed by the restoration of the rest, and by the removal of all the mischief that has been created. The mere introduction of fresh air into the lungs cannot at once restore the action of the heart, and still less that of the diaphragm, and the other muscles which are concerned in respiration, because these muscles have lost either the whole or the greater part of their irritability, in consequence of their having been supplied with venous instead of arterial blood. While our first and principal object is to bring the blood contained in the pulmonary vessels under the influence of atmospheric air, attention must at the same time be paid to the state of the circulation, and to the restoration of those powers by which that function, as well as respiration, is to be carried on. This double object should constantly be kept in view in all our attempts at resuscitation.

The first of these objects can be accomplished only by the artificial inflation of the lungs, and this should be done with as little delay as possible. The second object is to be attempted by the judicious application of stimulants applied to various parts of the body, so as indirectly to excite the powers of the nerves and muscles. Warmth, friction, and electricity are among the most efficacious of these means. The particular mode of their application will depend upon the peculiar circumstances of each individual case, and will come more properly to be considered when we treat specifically of each kind of asphyxia. But as the most important points in the management are common to all cases, we shall proceed to consider them in this place, as properly belonging to the general view we are now taking of the subject. Valuable directions as to the most effectual methods for recovering persons under asphyxia have been collected and published by the Royal Humane Society; of these we shall give an abstract, together with such additions as have been suggested and recommended by various authorities.

It should be borne in mind that in all cases of asphyxia, the first and principal measure to be adopted is the employment of artificial respiration; but if we have not the means of putting this into execution, the next measure, in point of importance, if the body be cold, as it generally is, is the application of warmth, which should be resorted to without loss of time: and, as it can be done without interfering with the process of inflating the lungs, both methods may be employed simultaneously.

Several preparatory steps should be taken before beginning the process for resuscitation. The body should be stripped of its clothing, and wrapped in warm blankets. It should be placed on its back on a table, with the head, shoulders, and chest somewhat raised; and supported in that position. The windows and door of the room should be kept open in order to obtain as free a circulation of pure air as possible; and for the same reason no more persons should be admitted into the room than are absolutely necessary. Bottles of hot water should be laid below the feet, in the joints of the knees, and under the arm-pits, if any coldness is perceived in these parts. Warmth is particularly efficacious in restoring the circulation when it is applied to the region of the stomach. Immersing the body in a warm bath has been also recommended, and may in many cases be advantageous. Great caution, however, is to be exercised in the employment of this, as well as of other modes of suddenly imparting considerable heat. The degree in which it should be applied so as to contribute most to the patient's recovery will, indeed, depend upon a variety of circumstances which should be duly weighed. It is well known that during the healthy state of the system, while the circulation is vigorous, the temperature of the body may be raised many degrees above the natural standard without injury to the powers of life; but it appears, on the other hand, from the results of experiments on hybernating animals, that when the circulation of the blood has ceased, and the temperature of the body has been very considerably reduced, if heat be then applied either very suddenly or in a high degree, life is soon destroyed: whereas, if it be applied to the same animals gradually, and in a very low degree, the vital powers are excited into action, and the functions are soon restored. Since the condition of the body in asphyxia, as Dr. Goodwyn remarks, (Connexion of Life with Respiration, p. 110,) is very analogous to the state of torpor which prevails in these animals, and since the progression of recovery is also the same, it is not unreasonable to conclude that heat will produce the same effects on the body in this disease as in torpid animals. To favour the recovery, then, most effectually, the application of heat should be conducted on the same plan that nature has pointed out in the awakening of hybernating animals from their state of torpor; that is, it should be applied very gradually and uniformly. Accordingly it may be raised to 98°, but not beyond 100°.

Nothing, however, should divert our attention from the means on which we are principally to found our hope of success, namely, the extensive application of fresh air to the pulmonary vessels. There are several ways in which this may be attempted. The first and simplest mode is to endeavour to imitate as much as possible the movements in natural respiration, by first applying pressure to the chest and abdomen so as to compress the lungs, and expel a great part of the carbonised air which they must necessarily contain; then removing that pressure, so as to allow the lungs and the sides of the chest to recover their former dimensions by their natural elasticity. In so doing they will necessarily draw in fresh air through the trachea. By repeating this double operation at short intervals, so as to imitate the natural periods of inspiration and expiration, we may give the patient a chance of recovery by determining the commencement of circulation, at that critical time when the vital powers are quickly fleeting away, and every moment is of the utmost consequence. But these attempts to supply the moving powers of the chest are always imperfect, and can at best be considered as only auxiliary to more efficacious methods. Still, however, they may be practised when no better assistance can be procured, or in the intervals of other processes.

The object being to introduce pure air into the inmost recesses of the air cells, so as to exert a chemical action upon the blood in the pulmonary vessels, some degree of force must be used in order to overcome the mechanical obstacles to its admission. For this purpose a considerable quantity of air should be introduced at each inflation; for, as Dr. Goodwyn observes, if only twelve cubic inches be injected at a time, this small quantity will occupy the larger branches of the trachea, and consequently only a small number of the pulmonary vessels will be exposed to its action: but if a much greater quantity of air be forced in at each time, some of it will pass into all the more remote cells; and when they are thus uniformly distended, the pulmonary veins, the sinus venosus, and left auricle, will be exposed as much as possible to its action, and some of the arterialized blood may be forced into them from the capillary vessels. Hence Dr. Goodwyn recommends that upwards of a hundred cubic inches of air should be introduced into the lungs of an adult at each inflation, and carefully drawn out again before more is introduced.

In situations where no proper apparatus is at hand, air should be blown with force into the lungs by applying the mouth of the operator to that of the patient, closing his nostrils with one hand, and gently expelling the air again by pressing the chest with the other, so as to imitate the strong breathing of a healthy person. If any difficulty be found in inflating the lungs in this way, it may be attempted by blowing through one of the nostrils, keeping at the same time the other closed. This operation is much facilitated by interposing a short wooden pipe, of a size adapted to the nostril, into which it is to be inserted at one end, while the other is applied to the mouth of the person who is to blow through it. The same tube will also be useful for receiving the pipe of a pair of bellows, when this instrument can be procured.

The blowing of air into the lungs of the patient from the mouth of a person, who must necessarily have breathed that air, and therefore vitiated it, has been objected to as being inconsistent with the very purpose we are aiming at, namely, the supply of pure and uncontaminated air to the pulmonary cells. On the other hand it has been thought preferable, from its introducing the air at a higher temperature than that of the atmosphere; but it is certainly of much greater importance that the air which is sent into the lungs should contain its full proportion of oxygen than that it be of the temperature of the body. Wherever, therefore, a bellows, or other apparatus for the artificial inflation of the lungs can be procured, we should not hesitate to employ it immediately, in preference to any other method.

The only instrument absolutely requisite for the performance of this operation is a common bellows: but the services of an assistant will be required in every case. The pipe of the bellows being inserted into the nostrils of the patient, the assistant must close the mouth and the opposite nostril, and at the same time gently press back the trachea, directing it also a little downwards, by pressing his finger upon the most prominent part of the larynx, commonly called the *pomum Adami*, or *Adam's apple*. The bellows is then to be opened, and immediately afterwards closed, so as to force air into the lungs. Its action is now to be stopped; the nostril that had been closed should be allowed to open, and the lungs made to collapse by pressing down the chest, so as to expel the air as completely as possible. These actions should be repeated about fifteen times in a minute, so as to imitate the natural movements which take place in respiration.

The process of inflating the lungs may be performed somewhat more readily and more completely with instruments constructed for this express purpose. The bellows employed with this view by the Royal Humane Society differs in no respect from an ordinary bellows, only that it is more accurately made, and is provided with a short flexible tube, one end of which fits on to the nozzle of the bellows, and the other is inserted into a silver tube, which is to be introduced into the nostril.

In the Report of the Humane Society it is stated that, as the trachea is always open through the glottis, air conveyed through the mouth, the nostrils being closed, would necessarily pass into the lungs. If the cartilage of the larynx be pressed against the vertebræ, which it ought always to be, so as to close the œsophagus, and prevent the passage of the air into the stomach, and at the same time the mouth and left nostril be closed, and the pipe of the bellows inserted into the right nostril, the air must necessarily pass into the lungs through the trachea, this being the only opening through which it can find its way.

Dr. Curry, in his "Observations on Apparent Death," (p. 48.) gives the following excellent directions for conducting this process:—

"While an assistant sustains the box-wood tube (into which a common pair of bellows can be made, by the assistance of a strip of linen, riband, or tape, to fit accurately) in one nostril, and stops the other nostril with his left hand, and with his right hand accurately closes the mouth, another assistant (who ought to be placed on the opposite or left hand of the body) is, with his right hand, to press backwards, and draw gently downwards towards the chest the upper end of the wind-pipe, that part which lies a little below the chin, and which, from its prominence in men, is vulgarly called *Adam's apple;* by doing this, the gullet, or passage into the stomach, will be completely stopped up, whilst the wind-pipe will be rendered more open to let the air pass freely into the lungs. The left hand of this second assistant is to be spread lightly over the pit of the stomach, ready to compress the chest and expel the air again, as soon as the lungs have been moderately filled; the first assistant unstopping the mouth or nostril at the same time, to let the air escape. The same operation is to be repeated, in a regular and steady manner, either until natural respiration begins, or until this and the other measures recommended have been persisted in for at least *six hours,* without any appearance of returning life."

It has been proposed to inflate the lungs with oxygen gas instead of atmospheric air; and it is *exceedingly* probable that if a supply of that gas were immediately at hand, together with every facility in the way of apparatus for administering it, its efficacy, in restoring animation, would be superior to that of common air. But the cases must be exceedingly rare in which we can command these means, and, whenever they are not in complete readiness, it would be very wrong to lose any time in waiting till we can obtain them. We are not aware, indeed, of any set of experiments having been instituted for the express purpose of ascertaining the superiority of oxygen gas over common air as a means of resuscitation in asphyxia, except those of Dr. Goodwyn, who merely says that he has employed oxygen gas in several instances in the smaller animals, and that the recovery was commonly more expeditious than where atmospheric air was used: but at the same time he acknowledges that he had never been able to recover an animal by means of oxygen gas where good atmospheric air had been ineffectual.

As a last resource, when the ordinary methods of inflating the lungs have entirely failed of success, and more especially if there be reason to presume that the chief source of difficulty arises from obstructions in the larynx and trachea, the operation of bronchotomy may be resorted to; which will allow of the forcible and more perfect inflation of the lungs by means of a pipe introduced into the opening made in the trachea. But it is only under particular circumstances that we need resort to this expedient.

Various kinds of apparatus, some of a very complicated description, have been, at different times, proposed to be employed for the purpose of effecting the complete inflation of the lungs. But, in general, more is lost than gained by resorting to complex mechanical contrivances, which are often out of order at the very moment when they are wanted, and which always require time for their adjustment, and practical skill in their management. The simple instrument we have described, namely, the common bellows, with a pipe adjusted to its nozzle, will be found sufficient to answer every practical purpose; and even the latter may be easily dispensed with, if the pipe of the bellows be accurately applied to the nostril of the patient. By the introduction of a catheter into the trachea, if such an instrument be at hand, the lungs may be very conveniently and effectually inflated by blowing air through the tube.

[In recent times, it has been shown, that the apparently simple operation of inflating the lungs is not as devoid of danger as was for a long time imagined; and it has been attempted to prove, that many cases may have resulted fatally from the violence of the insufflation, and consequent lesion of the pulmonary structure. To prevent these results, M. Leroy d'Etiolles recommends, that a graduated arc of a circle should be adapted to the handles of the bellows. One end of this arc is attached to one handle, whilst the other passes through a mortise hole in the other handle. The extent to which the handles are separated is measured by the graduated arc, and thus the quantity of air sent into the lungs may be determined. With this bellows M. Leroy measured the quantity of air expired, without effort, into a bladder, by persons of different ages, and marked upon the arc of the circle the point to which the handle of the bellows was raised in each. He also had curved silver tubes, to be introduced into the glottis, made of different calibres according to the age, so as to render it impracticable to introduce the proper quantity of air, as indicated on the arc of the bellows, more rapidly than would be inspired at that age. This apparatus is simple, and its adoption has been properly and strongly advised, on the ground, that verbal directions often fail to impress the mind with a due sense of the dangers attending insufflation, especially when it has to be performed in such excitement and confusion as cannot fail occasionally to diminish the caution even of experienced persons. In most of the cases of asphyxia, however, that occur, no such apparatus is at hand; and the operator is, consequently, constrained to make use of those agents that present themselves. These should of course be employed with the greatest precaution to prevent the evils that have been depicted by Leroy.]

Gentle friction of the body with a warm hand may, at the same time that we are proceeding with the inflation of the lungs, be employed at first as a means of increasing warmth, and subsequently, with a view of promoting the circulation of the blood. But the importance of friction, even as an auxiliary means of restoring life, has, we think, been much overrated.

The application of stimulants of various kinds has been recommended with the same intention of exciting the action of the heart and of the muscles of respiration. We should be exceedingly cautious, however, in the employment of these means, and should in general confine ourselves to those that are external. In the instructions for the recovery of drowned persons given by the Humane Society, it is stated that irritation applied to the nostrils has considerable influence in calling into action the muscles of respiration;

and for this purpose it is recommended that the nostrils be occasionally touched with a feather dipped in spirits of hartshorn, aromatic spirit of vinegar, &c. With regard to applications of stimulants to the skin, they observe, that during life the skin loses sensibility in proportion as it is deprived of heat, and does not recover it again until the natural degree of warmth is restored. Hence it may be inferred that, before this heat has been recovered, all stimulating applications are useless, and, as far as they interfere with the other measures, must be positively prejudicial. When, however, the skin has in some degree recovered its sensibility, spirit of hartshorn, or *eau de luce*, closely applied, or a liniment composed of equal parts of spirit of hartshorn and salad oil, may be rubbed on the wrists, ankles, temples, and parts opposite to the stomach and heart.

It has also been recommended to introduce warm and stimulating fluids into the stomach by means of a syringe and flexible tube, such as that generally attached to the stomach-pump; for until the power of swallowing is pretty well restored, it would be dangerous to attempt getting fluids down the throat in any other way. Half a pint of warm negus, or water with spirits of hartshorn, mustard, or essence of peppermint, may thus be given. The best time for administering a stimulating cordial of this kind is a few minutes after the process of inflation is begun. A clyster of a pint or more of water moderately warmed, with the addition of the materials before mentioned, or of rum, brandy, or gin, may be administered. Such, at least, is the advice given by the Humane Society, in cases of drowning, which may be considered as on the whole judicious, provided proper caution be used in not going beyond them. Mr. Hunter certainly went much too far when he recommended the application of stimulating vapours to the interior of the lungs. (Observations on the Animal Economy, p. 136.) Fortunately for the patient, as Dr. Bostock remarks, the natural actions of the organs are commonly sufficient to exclude the vapours; for, were they admitted in any considerable quantity, suffocation would be the consequence. The only use of stimulating vapours, is to excite the nerves of the nose, which, by their connexion with the respiratory nerves generally, may eventually stimulate the diaphragm to contraction. Not contented with the forcible injection into the stomach of stimulating liquids, some have advised the introduction of a piece of sponge impregnated with them, and fixed to the end of a small rod of whalebone, in order that the sides of the stomach may be, as it were, *mopped round* by the sponge thus charged, and stimulated in every direction. (Good's Study of Medicine, vol. iii. p. 562.) In the Berlin Transactions we find a recommendation of the use of a *ventriculi executia*, or stomach-brush, to produce internal friction in the same manner. Dr. Good, however, prefers the *stomach-mop*. It is hardly necessary to caution the reader against the adoption of these extravagant proposals. Neither can we approve of the recommendation of the internal use of phosphorus, also recommended by Dr. Good, on the authority of some German physicians, as one of the most powerful stimulants yet known.

Various other expedients have been suggested, as means of assisting recovery, which are not merely of dubious utility, but should be reprobated as exceedingly dangerous, and likely to frustrate the very object we have in view. To this head may be referred emetics, which should never be given; and also tobacco clysters, either in the form of smoke or infusion, the tendency of which is to destroy instead of increasing the irritability of the system.

Slight shocks of electricity, or of galvanism, transmitted through the diaphragm or heart, may possibly be used with considerable advantage in many cases; for this agent has the power of exciting the contraction of a muscle which can be no longer acted upon by any other means. The galvanic apparatus being very portable, and not affected by the state of the atmosphere, it seems to be preferable, in cases of asphyxia, to the ordinary forms of electricity. It is easily applied, and its force can be exactly regulated by the number of plates we may employ.

[A new method of application has been suggested by M. Leroy d'Etiolles. (Magendie's *Journal de Physiologie*, tom. vii., viii., and ix., and *Recherches expérimentales sur l'Asphyxie*, Paris, 1829.) He introduced an acupuncture needle on each side, between the 8th and 9th ribs, until the needles reached the fibres of the diaphragm. He then established a galvanic current between these by means of a pile of 25 or 30 pairs of plates an inch in diameter. The diaphragm immediately contracted, and an inspiration was made. He now interrupted the circle, when the diaphragm, urged by the weight of the abdominal viscera, and aided by gentle pressure made on the abdomen with the hand, returned to its former position, and an expiration was accomplished. In this way, the two respiratory acts were made to succeed each other, and regular respiration was re-induced. A continuous current was likewise applied in some cases, but the respiratory movements were irregular, and nothing like natural respiration resulted. Leroy tried his method on animals asphyxied by submersion, and when they had not been under water more than five minutes, they were often resuscitated. On different occasions, he asphyxied animals of the same species, and apparently of like strength, and whilst those that were left to themselves perished, those that were treated by galvanism recovered. A case has been published in which the galvanic influence from a battery of fifty plates was applied immediately to the diaphragm through an incision made below the seventh rib. The muscles of the chest and abdomen were instantly thrown into spasmodic action, which subsided in a few minutes into the regular movements of respiration. The man had been six or seven minutes under water. (Art. Asphyxia, in *Cyclopedia of Practical Medicine and Surgery*, vol. 2, Philad. 1836; and Dunglison's *Practice of Medicine*, 2d edit., p. 421, Philad. 1844.)]

Bleeding has been recommended by physicians of high authority; but it is only under particular circumstances that we can expect it to be beneficial. In general its effects would be injurious: its use is strongly reprobated by Mr. Hunter, and it is now scarcely ever had recourse to, unless there are very unequivocal indications of great pressure on the brain.

The processes above recommended should be diligently persisted in for several hours; unless evident indications of death appear, such as stiffness of the limbs, dimness of the eyes, &c.

[When the heart has once ceased to beat, however, it is extremely difficult to restore it. It is important to bear in mind the cases on record, in which resuscitation has been effected, as in asphyxia from drowning, after an immersion of several minutes; but, at the same time, we must reject, unhesitatingly, many of the marvellous stories that have been handed down on this subject. Notwithstanding these traditionary histories, and the philanthropic recommendation that our attempts at resuscitation should be continued for several hours in cases of asphyxia, it is but too true, that our efforts will generally be fruitless after a perfect asphyxia of a few minutes' duration. On the occasion of a melancholy catastrophe at Albany, in the State of New York, in August, 1840, when many persons were submerged, although some of the persons were removed from the water in less than five minutes, and in two or three cases respiration was imperfectly performed, in no single instance did the medical gentlemen succeed in their well-directed efforts at entire resuscitation. (Dunglison's *Practice of Medicine*, edit. cit., p. 415.)]

The first signs of returning life are slight convulsive twitchings in the muscles of respiration, giving rise to gaspings and sighings. By degrees these spontaneous efforts become more regular, and natural respiration is restored; and together with this the circulation returns. Slight palpitation is sometimes felt at this period: on the appearance of these signs our efforts must be redoubled; for the crisis is arrived when the life of the patient is still exposed to much hazard, and can be saved only by the utmost care and attention. Some time must yet elapse before the vivifying influence of the freshly generated arterial blood can be extended over the system generally, and especially before the functions of the brain are restored. The first return to sensation is usually attended with great suffering; and the first expressions of the feelings of the patient are not those of gratitude to his benefactors, but are rather those of bitter complaint and deep resentment.

There still exists, indeed, a period of danger after the breathing has been restored and the circulation re-established, at which death may take place when we are least prepared to expect it. When animation returns, therefore, the patient should not be left alone, but watched lest he should require further assistance; for many have been lost from want of attention, who might otherwise have been easily saved. We may quote in illustration the following case mentioned by Dr. Paris, (In his Life of Sir Humphry Davy, 4to. edit., p. 69,) which happened in the neighbourhood of Windsor. A corporal of the Guards, of the name of Schofield, was seized with cramp as he was bathing in the Thames, and remained for several minutes under water. By judicious assistance, however, he was recovered, and appeared to those about him to be free from any danger, when he was attacked with convulsions, and expired. Had the respiration been artificially supported at this period, so as to have maintained the action of the heart until the black blood had returned from the brain, it is probable that the life of the soldier might have been preserved.

It has sometimes happened that the return of sensation has been attended with delirium, or been followed by an attack of temporary mania. Care, indeed, is always requisite, even after the functions have been restored, to guard against the effects of morbid reaction, which gives rise to various inflammatory and febrile states.

Treatment of particular kinds of Asphyxia.—The treatment of asphyxia from the respiration of carbonic acid or any other of the irrespirable gases, is to be conducted upon the general principles above explained. The first step to be taken will naturally be to remove the body from the influence of the noxious gas, and expose it to a free and pure air. As the temperature of the body is generally raised above the natural standard, the affusion of cold water on the body may be employed with great advantage; for it acts as a powerful stimulant, in consequence of the strong impression made upon the skin, which is a very extensive sentient organ. Sprinkling cold water upon the face and breast is a milder mode of effecting the same object, and is well known to have considerable effect in rousing persons in a state of syncope. The dogs which are made the subjects of experment at the Grotto del Cane, are usually plunged into a neighbouring lake after exposure to the mephitic gas, as a means of hastening their recovery. It need hardly be observed that if the temperature of the body is below the natural standard, heat instead of cold should be applied.

A moderate bloodletting has been strongly recommended in this particular species of asphyxia, on the ground of its being indicated by the symptoms of pressure on the brain. It was conceived also that the contractions of the great vessels and cavities of the heart, which are in an over-distended state from accumulation of blood, would be facilitated when they were relieved by the evacuation of some portion of that excess.

But the theory upon which this recommendation rests is exceedingly doubtful. In the case recorded by Dr. Babington, bloodletting appeared to have an injurious effect, and we are, on the whole, disposed to agree in the opinion expressed by that judicious and experienced physician, namely, that the restoration of breathing is the natural and most effectual remedy to the altered balance in the circulating system. If, however, detraction of blood should be thought necessary, the end will be most quickly answered by opening the jugular vein, as recommended by M. Portal.

In the case above referred to, galvanic shocks were passed through the chest at intervals of half an hour, for some hours, with apparent benefit, as they seemed especially to excite to contraction of the muscles of respiration. Advantage seemed also to be derived from the forcible inhalation of oxygen gas. During the convalescence of this patient his mental power seemed to be much impaired, and he cried bitterly when any person entered the room; a state of imbecility which frequently occurs in ordinary paralytic affections. Violent pain in the stomach is said to be occasionally a sequel to this species of asphyxia, for which a brisk purge is the most efficacious remedy.

In cases of asphyxia from carburetted hydrogen gas, the treatment must be conducted upon the same general principles as in those from carbonic acid gas.

Treatment of asphyxia from drowning.—On the subject of the methods to be pursued for the recovery of drowned persons, we cannot do better than transcribe the following directions given by the Humane Society in their latest Report, (The Fifty-seventh Annual Report, 1831, p. 62,) as being those sanctioned by the most extensive experience.

After the body is found, particular care should be taken to employ the following means in the order described, and as quickly as possible; but in the precipitancy and confusion usual upon such occasions, cautiously to avoid every kind of violence and rough usage. It is of the utmost importance, first, to cleanse the mouth and nostrils, strip off the wet clothes, wipe and clean the body, and wrap it in dry clothes or blankets, before it is removed, in order to obviate evaporation, and the effects of exposure to a cold medium. By either of these causes the temperature of the body would be greatly reduced, and the prospect of resuscitation diminished. The colder the weather, the more desirable it will be to strip off the wet clothes, and promptly put on dry ones; this should be done upon the spot, unless a convenient place is near at hand to carry into execution the more material preparations. An error in the first steps of the resuscitative process may be fatal. It cannot, therefore, be too strongly urged upon those who humanely assist in these early moments, and who are seldom professional men, rigidly to adhere to these few articles of instruction, that they may thus effectually prepare the way for the restoration of life. If they attempt to take more upon themselves, their intentions, though good, may be subversive of the end in view, and defeat the designs of the medical attendant. More individuals are lost from the irregularity and want of order in the employment of the first means, than from any other cause. The time that is spent by the humane assistant in the faithful and exact adoption of these instructions, in the first steps of the resuscitative process, is as profitably employed as the time and judgment of the medical man can be; for he cannot exert his skill till the preparations have all been made. Neither the coldness of the body, nor the length of time it may have been under water, should dishearten the assistant from a vigorous and unremitting perseverance in his efforts. His services are, in short, incalculable.

In conveying the body, it will be necessary for the assistant to forbid persons lifting the body up by the shoulders, or taking hold of the legs, with a view to carry it forward; for in this posture it will be impossible to prevent the head from hanging back or bending forwards upon the breast, either of which positions of the head is injurious. The best way to carry the body is to place it in a recumbent posture on the back, with the head and breast raised, on a door or board, or in a cart.

When arrived in the room prepared to receive it, the body should be stripped and covered with warm blankets, and placed on a table of a convenient height to admit of the process being employed with facility; taking care to keep the head and chest raised, and to have the nostrils and mouth thoroughly cleansed. If these are in any degree obstructed, the resuscitative process is not likely to succeed. Both the nostrils and mouth should be free and open. The inflation of the lungs is then to be performed in the manner we have already described, in our general account of the treatment of asphyxia.

While some of the assistants are engaged in performing artificial respiration, others should be employed in communicating continued heat to the body. Dry, warm blankets, bags of warm grains, or sand-bladders, or bottles of hot water, or hot bricks, or blankets wrung out of hot water, are amongst the means most readily obtained. The body may be placed before the fire, or in the sunshine, if strong at the time. Whatever may be the particular means employed, the restoration of warmth should always be assiduously pursued. Should the accident happen in the neighbourhood of a steam-engine, brewhouse, bakehouse, or any place where warm water may easily be procured, it would be of great importance to place the body in a warm bath, moderated to a degree not exceeding 100°. The warmth most promising of success is that of a heated bed or blankets. Bottles of hot water should be laid at the bottom of the feet, to the joints of the knees, and under the arm-pits; and a warming-pan moderately heated, or hot bricks wrapped in cloths, should be passed over the body, and particularly in the direction of the spine. A large bladder should be applied, filled with hot water, and enclosed in flannel, to the region of the stomach. The natural and kindly warmth of a healthy person, lying by the side of the body, has been found in some cases of adults, and more particularly of children, very efficacious; but the warm bath, when it can be procured, is preferable to all other means of communicating heat.

With regard to the use of friction and the application of stimulants, the observations already given in the early part of this article apply in their fullest extent. Bleeding ought never to be employed in this stage of the process; though circumstances may occur to render it necessary when the circulation has returned, and a morbid reaction has taken place.

Treatment of cases of strangulation.—In the treatment of persons apparently dead from hanging, or any other mode of strangulation, the same means are to be enforced and persevered in as have been recommended for the recovery of those that have been drowned. The posture in which the body should be laid is the same, excepting that the head and shoulders should be raised somewhat higher. The fulness of the vessels of the head may be such as to require bleeding, which, of course, will be most effectual if done in the jugular vein. The quantity of blood to be abstracted must be merely enough to remove the excess that exists in the vessels of the head, but should not be so great as to weaken the powers of life. At subsequent periods of convalescence, there may, from excess of reaction, arise a necessity for taking away a much larger quantity.

In all cases where the cause of obstruction is in the trachea, such as those arising from the introduction of an extraneous body, or the closing of the passage from disease, the operation of bronchotomy affords the only chance of saving life.

P. M. Roget.

[**Asphyxia of the Newborn** — *Asphyxia neonatorum*. Should any thing interfere with the due passage of the blood along the umbilical cord, asphyxia will result; not owing only to the requisite changes of the blood in the placenta being prevented, but through the consequent interference with the circulation, which has to be effected by the cord and placenta, until the independent circulation is established by pulmonary respiration. We can thus understand, that if the cord should come down in such a manner as to be strongly compressed for some time before delivery, asphyxia may be produced. In like manner, when the breech, feet, or knees present, there is danger to the child, unless the delivery be rapid. Occasionally, too, the child is stillborn in consequence of some morbid condition of the organs of innervation. Thus, owing to pressure of the head in its passage through the pelvis, or to some modification in the encephalo-spinal centres, or in the nerves distributed to the respiratory organs, the function of respiration is not established, notwithstanding that the circulation appears to go on well along the cord. The child seems to be in an apoplectic condition.

Asphyxia may pre-exist longer in the newborn child than in the adult, in consequence of there being less need of a highly oxygenized blood for its support.

If all circulation have ceased in the cord, there can be no advantage in keeping the connection between the child and the placenta entire, especially as the union cannot fail to interfere with the due application of such resuscitative means as may be deemed necessary. At times, when the child is extruded, and the placental circulation continues, the stimulus of a smart stroke on the breech arouses the dormant energies, and it immediately begins to cry; but should this be insufficient, the infant had better be exposed to a moderately warm temperature,—for example, to the moderate warmth of a fire, so that the air may come in contact with a large surface of the body. Generally, immersion in a warm bath is had recourse to; but the rationale of its action is by no means unequivocal, whilst, as Dr. Kay has observed, (*The Physiology, Pathology, and Treatment of Asphyxia*, Lond. 1834,) it is not necessary to the application of a proper degree of warmth to the body of the child; it prevents the beneficial effects of the atmosphere on the skin; and moreover, is found to exert a depressing influence on the nervous and muscular systems.

In addition to these means, friction with the dry hand, or with stimulating liniments, especially over the regions of the chest and stomach, as well as the application of spirit to the nostrils, to rouse the respiratory nerves to action, have been recommended. Should any mucus obstruct the mouth and pharynx, it ought to be removed by means of the finger enveloped in a piece of fine linen, dry, or dipped in a solution of common salt. But, after all, these means are often found unsuccessful, and it becomes necessary to have recourse to artificial respiration. This is the great reliance of the practitioner in severe cases. Whilst artificial respiration is persisted in, the cord will often be observed to pulsate, and to cease when the operation is suspended. In the stillborn fœtus, it is not found practicable to execute insufflation by mere pressure on the chest, in the mode advised for the adult. In one case, Dr. Blundell diligently operated in that manner for fifteen or twenty minutes together, without producing resuscitation, and, on examining the child, on the following day, he found that scarcely a particle of air had entered the lungs. Nor can insufflation be readily effected by blowing in at the mouth. The only mode of doing it effectually, is by means of a curved canula, or other analogous instrument. The introduction of a curved tracheal pipe into the larynx is by no means difficult. All that is necessary is to pass the forefinger of the left hand upon the root of the tongue, as far as the opening of the larynx, and to insert the tube, held in the right hand, along the finger as a director. It will readily enter; and, by pressing on the neck, it can be easily discovered whether the instrument be in the trachea or the œsophagus. The lungs may then be inflated by blowing air from the lungs of the practitioner through the tube, and forcing it out again by pressing on the thorax and abdomen, and repeating this five-and-twenty or thirty times in a minute. In inflating, care must be taken that the air is not driven in too forcibly. The experiments of M. Leroy d'Etiolles, (*op. cit.*,) show, however, that insufflation may be performed with much less risk in the infant than in the adult, because the structure of the lungs is firmer in the former, and there is, consequently, less risk of rupture or dilatation of the air-cells. It is no great objection that the air sent into the lungs of the fœtus from those of the adult cannot be as efficacious as pure atmospheric air; the young being, as before observed, not requiring such highly oxygenized air as the adult.

It has been proposed that a small galvanic apparatus, like that recommended by Leroy, and before described, (p. 202,) might be used with advantage, to rouse the diaphragm to contraction. (Dunglison's *Practice of Medicine*, 2d edit. i. 444: Philad. 1844.)

The length of time during which the efforts of the practitioner ought to be continued, must be decided by his best discretion. Where, from the appearance of the fœtus, or other evidences, he has reason to believe that it has been for some time dead *in utero*, all his endeavours must necessarily fail. It is only in cases in which the child has perished in the birth, that any means can be effective; and in such case, the energetic measures already recommended, should be put in force, and not be abandoned until all hope is lost. So long as there is any hesitation in the mind of the practitioner, as to whether the child be dead, his efforts should be perseveringly continued.

When the attempts at resuscitation have been successful, the same attention is necessary, for a day or two afterwards, as in the varieties of asphyxia previously mentioned; and when there is reason to believe that the state of suspended animation is dependent on, or connected with, an apoplectic condition,—as where the respiration is very slow and laborious, and there is evidence of venous engorgement of the head and neck, with pulsation in the cord, advantage is often derived from permitting a teaspoonful or two of blood to flow.

ROBLEY DUNGLISON.]

ASTHMA.—The term asthma, like most terms in medicine which have been transmitted to us from antiquity, in the language of the people as well as of science, has been applied to a great many different affections. Its etymology[*] indeed justifies its use in all cases of difficult breathing; and it was long customary for physicians to apply it to every such case which was not produced by some known disease or other manifest cause. Very often the coexisting disease, although in fact the cause, was entirely overlooked, or, if noticed, was considered as a consequence of the disorder of the respiration. In popular language, every chronic shortness of breath, or dyspnœa, is still termed asthma, and this application of the term has certainly the sanction of many good practical and systematic writers up to a comparatively recent period. In another part of the present work, under the term DYSPNŒA, will be found an account of the different kinds of short-breathing, of a continued form, referred, for the most part, to the organic lesions on which they depend. In the present article, it is intended to confine our views chiefly to that variety of disordered respiration which, since the time of Willis more particularly, has commonly been denominated *spasmodic asthma*, and which may be briefly defined, a difficulty of breathing recurring in paroxysms, after intervals of comparative good health, and usually unaccompanied by fever.

History of Asthma.—Persons subject to asthma have generally more or less of warning of the approaching paroxysm. The precursory symptoms, however, vary greatly in different cases both as to their nature and the period of their appearance. Some patients have indications of the coming evil even some days previously to the attack; most have distinct notice of its approach, at least for some hours, but it occasionally attacks with scarcely any previous warning.

The more common precursory symptoms are the following: a feeling of general languor and oppression, yawning, heaviness of the head or drowsiness, distension of the stomach from flatulence, and a feeling of tightness across the lower part of the chest. Sometimes there is more distinct headach, with general restlessness and fretfulness towards evening, also dryness of the nostrils or fauces, and other signs of slight fever.[†] This feverish state of the system is strikingly indicated by a circumstance mentioned by Floyer, namely, that in such patients as have issues the wounds are apt to become sore and inflamed. Sometimes in place of dryness of the mouth or fauces, there is an increased flow of saliva, and still more frequently an increased flow of urine. In most cases, the discharge of limpid urine, which almost always is connected with the disease, does not begin until after the invasion of the paroxysm; but occasionally it comes on long before this, even a day or two previously, and is the first indication of the approaching attack.[†] Many other symptoms, perhaps of a very slight kind in themselves, but too significant to the experienced patient, present themselves in particular cases. All the primary disturbances most commonly become more manifest towards night, and it is often amid their increasing violence that the dispirited patient retires to bed anticipating evil. Nevertheless, sleep not unfrequently occurs, and it is only after some hours' rest, that the patient is suddenly roused by uneasy sensations, and then finds that the asthmatic fit is already present. In some instances the patient does not immediately awake on the invasion of the paroxysm, but continues in a state of half-consciousness approaching to incubus, aware of the approach of the disease, yet with scarcely the power to make even the usual instinctive efforts to resist it. On becoming thoroughly awake, he finds the overwhelming symptoms to be—a great weight, tightness and constriction of the chest, almost depriving him of the power of dilating it. He raises himself up, or gets out of bed, panting and gasping for breath, and often wheezing so loud as to be heard at a considerable distance. He calls or makes signs to have the doors and windows opened, and frequently sits at the latter for hours together, regardless of the cold, and caring only for fresh air, "as if (in the words of Aretæus) the house were too small and too confined for his breathing." We have known a poor patient in such circumstances, not merely remain by the open window, but lean over it resting on the sill, with the arm hanging on the outside, for several nights together, and even in winter. It is a fact well worthy of notice, that in such cases the patients, although at other times very susceptible, rarely suffer, either immediately or subsequently, from the effects of the cold to which they are exposed. This circumstance is, in itself, sufficient to prove, as will be more particularly noticed hereafter, how profoundly and extensively involved is the whole nervous system in the asthmatic paroxysm. But although the feelings of the patient instinctively require cool air, or, at least, unconfined air, and the trunk of the body is generally covered with perspiration, the extremities are almost always cold. The countenance is generally anxious and haggard, and the face very pale; sometimes, however, it is flushed or even livid. There is usually a tickling dry cough; but this, as well as the other functions of the respiratory and vocal organs, is very imperfectly performed. "The asthmatic (says Floyer) can neither cough, sneeze, spit, nor speak freely." Almost always there is a copious flow of pale urine, as in hysterical diseases; and at the commencement of the fit, the bowels are frequently relaxed, with somewhat of the impatient hurry and imperfection of spasmodic action. The pulse is generally very frequent, small and feeble, and occasionally irregular; and in many cases there is palpitation from the beginning of the paroxysm. Sometimes, however, the pulse does not vary greatly from the state of health, and palpitation is often absent. The great distress of the patient appears to consist in the painful constriction of the chest, and the consequent inability to inspire a sufficient quantity of air to remove the sense of suffocation. Unlike angina pectoris, which has some other points of similarity with it, the asthmatic paroxysm cannot be said to be productive of pain, in the usual sense of that word; nor is the mind of the patient overwhelmed with the apprehension of impending dissolution. On the contrary, the asthmatic is supported with the hope and assured conviction that his sufferings will not be of long duration. And such is generally the case. After two, three, or more hours, the severity of the attack begins to decrease, the constriction of the chest gradually relaxes, the inspirations are easier and deeper; the cough becomes freer, and is now attended by a loose and sometimes a copious expectoration, which is always hailed by the patient as at once the sign and means of his relief. Exhausted by his sufferings, and soothed by the contrast of ease, the patient very generally falls asleep, and the disease is for the present at an end. In many cases, with this single paroxysm the disease takes leave of the patient for the present, there being an almost perfect restoration of his health on the following day. Very frequently, however, after an incomplete resolution of the paroxysm, a second makes its appearance on the following night, and this alternation of suffering and comparative health may go on for several days before the patient is completely freed from his enemy, and a perfect intermission is established. After the paroxysms there frequently remains much soreness in the chest, arising partly from the strong but abortive efforts of the muscles to expand the chest, and partly from the cough. Sometimes these pains are very severe, resembling the pleuritic stitch, and might by the inexperienced be mistaken for such. However, the knowledge that any internal inflammation is a very rare consequence of asthma, together with the external soreness, and great increase of the pains on motion, will readily point out to the experienced practitioner the exact nature of the case.

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[*] Ἄω, ἀάω, spiro—*ἀάζω*, anhelo—*ἄημα*, spiritus—*ἀσθμάζω*, spiritum difficulter traho—*ἆσθμα*, anhelatio, *asthma*.

[†] Vigilant, noctuque parum et obscurè incalescunt. *Aretæus* morb. diutur. lib. i. cap. xi.

[‡] *Floyer* on the asthma, p. 7. *Whytt's* works, p. 602.

On inspecting the chest of a patient in an asthmatic paroxysm, it is found to be much less mobile than during ordinary respiration. The whole of the upper parts of the thorax seem, indeed, to be almost entirely without motion, and the inferior parts are acting within a very confined range. The abdominal muscles are, as it were, unbraced, and seem to be acting with greater freedom but much less force than usual. They appear to have lost their usual support beneath, as if the viscera were retracted from them, and they were playing backwards and forwards over a hollow space. The stethoscope conveys scarcely any respiratory sound during inspiration, except an indistinct hollow sort of murmur, altogether unlike the usual respiratory sound, and so slight as to leave it doubtful if the impression conveyed to the ear is really a sound or only a vibration. Expiration, however, is distinctly marked over the greater part of the chest, not, indeed, by the sound of healthy respiration, but by a loud sibilant or dry sonorous rhonchus, corresponding with the loud sighing wheeze audible by the naked ear. This rhonchus is often exactly like the sighing of wind through crevices; and sometimes the tone and key of the sound approach nearer those of a moan than a sigh. The sounds are perceptible, during expiration, over the whole chest, even in the extreme points of the lungs; and equally so in patients whose respiration is nearly inaudible in the intervals of the paroxysms.

In the intervals, the condition of different patients varies still more than in the paroxysm. In some there remains scarcely any sign of disease either in the organ of respiration or in the general system; but in the great majority of cases there are obvious symptoms of the suffering of both, although the patients themselves are often disposed to deny or make light of them. The contrast between their present condition and their sufferings in the paroxysm, is so great, that they are naturally led to underrate or disregard any slight deviations from the state of perfect health which may still remain; and as they are frequently not incapacitated for the common offices and amusements of society, they may seem also, to the common observer, to be free from disease. But their state will rarely, if ever, stand the test of the inquiry of the physician. In almost every case there will be found, on examination, some permanent local disease of the organs of respiration, or of some other organ; or there will be found some considerable depravation of one, or of more than one important function; or there will be a combination of all these, constituting a complex chronic disease, which may involve, in a greater or less degree, the whole system. As the asthmatic paroxysms are frequently produced, or, at least, kept up and aggravated, by the attendant morbid conditions of the system, and as the successful treatment of these, as of all diseases, will greatly depend on the precise knowledge of their nature possessed by the practitioner, it becomes a matter of the greatest importance to investigate the habitual state of health of asthmatic patients.

When the disease has been of long standing, besides the organic or functional lesions of internal organs indicated by the ordinary signs and symptoms, the asthmatic patient bears in his gait, in the form of his chest, and in his physiognomy, the indelible and unequivocal impress of his disease.* The explanation of the physical alteration of the configuration of the chest, countenance, &c. is obvious, and has reference to the efforts made by the muscles of inspiration, in the paroxysms, to dilate the chest when compressed. In a great proportion of cases there exists a marked alteration in the natural sounds of respiration, as detected by the stethoscope. The sound is either altogether absent, or very much diminished in the greater part of the chest. In some places it is more distinct, but still much feebler than in the state of health. Occasionally the feeble sounds are interrupted by a recurrent sibilous rhonchus, or click, like that of a valve. At the same time of respiration? Or is it in more or fewer of these parts at the same time?

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* In morbi cessationibus licet ipsi non decumbentes obambulent, secum tamen illius signum circumferunt.—*Aretæus, loc. cit.*

These questions demand a moment's consideration.

There are several forms of spasmodic stricture of the upper portion of the air-tube, more particularly of the glottis, well known to practical physicians. The more common of these occur in infants and young children; but they are confined to no particular period of life. An old lady, a friend of the writer of this article, has all her life been liable to attacks of this kind, which seize her instantaneously, after long intervals, and, during their continuance, entirely prevent inspiration, and thus threaten immediate death. After a few seconds the paroxysm subsides, without leaving a trace behind it. The disease described by Dr. John Clarke as a "peculiar species of convulsion in infant children," and of which a more complete account has recently been published by Dr. Marsh, (Dublin Hosp. Reports, vol. v. p. 600,) is evidently a spasmodic affection of the same kind, but less strictly confined to the glottis than in the case just mentioned. In the infantile disorder, the spasmodic disposition frequently extends over the whole muscular system, inducing general convulsions. The disease frequently termed *spasmodic croup*, and which occurs also most commonly in children, but at a somewhat later period, consists, in like manner, in numerous instances, in a spasmodic affection of the glottis; but, in this case likewise, the spasms frequently extend further, in many instances affecting the greater part of the air-tubes. When this is the case, the disease is, in truth, a form of asthma, and ought rather to be named infantile asthma than spasmodic croup. A few practical writers represent the common form of asthma, in adults, as consisting almost exclusively of spasm of the same parts; and, among others, Dr. Wilson Philip. "The spasmodic asthma (says this author, in his recent work,) appears, properly speaking, not to be a disease of the lungs themselves, but of the parts of the upper extremity of the wind-pipe, in which the contraction of the passage of the air, by spasm of its muscles, produces the violent struggling for breath which attends its paroxysms." We shall examine the validity of this opinion after having noticed the other theories. The chief of these is that which represents the asthmatic paroxysm as consisting in a spasm of the external muscles of respiration.

One would imagine that it could be no very difficult matter to determine, after an inspection of the naked chest of a patient in a fit of asthma, whether the external respiratory muscles were in a state of spasm or not: and we cannot help suspecting that some of those who have been the strongest advocates for the affirmative of this proposition, have taken but little trouble to ascertain its truth in the most natural and simple way. Our own observations have invariably led to the conclusion that all the muscles of which the action is perceptible, are, during the paroxysm, exerting themselves strongly to *dilate* the chest; and there are the strongest reasons for believing that the muscles, the action of which is concealed, are in the same condition. It is universally admitted that expiration is, in ordinary cases, effected, in a great measure, by the mere mechanical sinking of the walls of the chest, upon the cessation of the active muscular efforts of inspiration. The ribs descend and the diaphragm ascends, and necessarily, upon the relaxation of the muscular fibres, the contraction of which had enlarged the cavity of the chest. And if we take into consideration the immense superiority of power of the muscles of inspiration, and remember that these are all, during the paroxysms, exerting themselves to the utmost to dilate the chest, it seems extremely improbable that the power of their feeble antagonists, however exerted, could resist them.

But independently of these negative proofs, we have many direct ones that the principal site of the spasm is in the air-passages, and that the instinctive and voluntary efforts of the muscles of inspiration are almost exclusively directed to overcome this. Some of these direct proofs are the following. Asthma, as we shall soon see more particularly, is very commonly dependent on a diseased state of the bronchial membrane, and the attacks are frequently induced by an increase of this state. The resolution of a paroxysm is almost invariably accompanied by a great increase of secretion from the bronchi, which could hardly be expected to be the case if the affection were seated either in the muscles of the glottis or in the *external* muscles of respiration. Diseases of the bronchi, which produce a similar contraction of the air-passages by mere swelling of the membrane; namely bronchitis, and an affection producing nearly the same physical condition of the parts from a sudden congestion of the blood-vessels, give rise to a state of respiration very like that which obtains in the asthmatic paroxysm. Auscultation of the respiration, during the paroxysm, discovers particular sounds over the whole extent of the chest, which sounds can only have their site in the bronchial tubes; and as these sounds come on and go off with the paroxysm, it seems a necessary conclusion that they depend on the physical changes produced by this, and that those changes take place in the bronchi. Common wheezing, as heard by the unassisted ear in asthma and in most cases of dyspnœa, may exist in a very marked degree without the auscultatory rhonchus, which may be considered the pathognomonic sign of bronchial infarction from whatever cause derived.

But while, for these reasons, we think it must be allowed that the main site of the spasms which constitute the asthmatic paroxysm is the bronchi, we are by no means of opinion that they are exclusively confined to these. On the contrary, we think it very certain that not only all the parts already mentioned, but others still more remote, are frequently involved in the same disordered action. This is what must have been anticipated from a consideration of the very nature of the affection. In all spasmodic diseases there is a disposition towards extension of the spasm from the original or principal site, and, indeed, this fact is perhaps more easily explained on physiological principles than the restriction of the spasm to one part or one set of muscles could be. In all these cases, if the nervous centres are not primarily affected, they invariably become so subsequently; and the circumscription of the local manifestation of the spasm to the muscles first disordered thence becomes very improbable. Besides, we know that muscles whose actions are at all associated, are very liable to suffer generally when one or more of the class are morbidly affected. And, in the present case, we admit that the muscles both of the larynx and the chest are frequently involved in the progress of the paroxysm. They are, however, we believe, in almost every case, affected secondarily, and it is therefore impossible to subscribe to the opinions of those who wish to make them the chief site of the asthmatic spasm. Other muscular affections, of a spasmodic kind, are not uncommon in the paroxysm of asthma. The sudden calls to empty the bowels are no doubt partly owing to a morbid action of the muscles concerned in this process; although chiefly, perhaps, the consequence of the same general disorder of the nervous and vascular systems, which gives rise to the pallid and shrunk state of the surface, the flow of limpid urine, &c. In a young man, now under our care, subject for some years to periodic asthma, which generally attacks him during sleep, the first indication he has of the invasion of the paroxysm is an involuntary spasmodic twitching of the right foot or leg, of which he is conscious for some time before he is fully awake, and of which the increasing violence awakens him. The twitching always leaves him on his becoming fully awake, but he then finds himself under the full dominion of his asthma.

It must not be imagined from any thing that has been stated, that we consider the asthmatic paroxysm as consisting exclusively of a muscular spasm of parts otherwise healthy. This, indeed, may be the case in a few instances; but it is not to be doubted that, in the great majority of cases, the spasm not merely affects parts previously diseased, but that the phenomena of the paroxysm are partly dependent on, and greatly modified by, these very lesions co-existing with the spasm, aggravating it, and, in turn, being aggravated by it.

Varieties of Asthma.—Several methods present themselves for classifying the different forms of asthma met with in practice. Our limits do not permit us to enter into any discussion as to their respective merits, nor to give our reasons for preferring that which is here adopted, further than to state that we think all classifications of diseases ought to be founded, when practicable, on the pathological condition of the affected parts.

On this principle we shall divide cases of asthma into two classes or groups, according as there exists a sound or a diseased state of the bronchial membrane in the intervals of the paroxysms; terming those of the first class *nervous asthma*, and those of the second *catarrhal asthma*. We shall now notice these in order.

I. *Nervous asthma.*—The characteristic quality, or, at least, the most manifest physiological peculiarity of the individuals subject to nervous asthma, is the extreme susceptibility of their nervous system. They are said, in common language, to be nervous, or to possess the nervous temperament. This is the asthma of hysterical females, and is indeed, in many cases, only one of the multiform aspects of hysteria. It, however, occurs equally in males, and in females who have no other symptom of hysteria. Every one must admit that in persons subject to asthma mere moral causes frequently suffice to induce a paroxysm; and it seems, at least, extremely probable that similar causes, when more intense, or when the individual susceptibility is greater, may give rise to the disease in persons not previously subject to it. The records of practical medicine contain innumerable examples of the influence of the nervous system over the asthmatic paroxysm. In Dr. Parry's posthumous works some curious cases of this kind are given. In one, severe dyspnœa with irregular action of the heart was instantaneously produced, in the presence of Dr. Parry, by mental agitation. The paroxysm lasted eight or nine days, and terminated with considerable mucous expectoration, showing, by the way, the power of a mere nervous affection to produce, by its continuance, local disease. In another case of old and well-marked asthma, the same physician witnessed the instantaneous removal of the paroxysm by fright. Many cases of an analogous character might be quoted from authors, and most of our readers of long experience in practice must have met with similar instances. The following case, extracted from Dr. Whytt's work on the nervous system, is a striking example of the disease now under consideration. "A girl, healthful, well-made, and of a seemingly good constitution, began, at the age of seven years, to complain of a pain at the lower part of the sternum; this pain, which returned after no certain intervals, became gradually more severe during the space of nearly two years, after which, in place of it, the patient began to be affected, at times, with a difficulty of breathing, which returned frequently, without observing any certain periods; as a week, a fortnight, or a month would sometimes intervene between the fits. She was generally seized with the fits all at once; and after breathing with the utmost difficulty for half an hour, sometimes more than an hour, she would, of a sudden, become perfectly well, and fall a-dancing immediately after with her companions. It was observable that this girl had no complaint of her stomach, no cough, nor other apparent fault in her lungs; nor did she usually expectorate phlegm when the fit went off; and, except in time of the asthmatic paroxysm, breathed with the same ease as any person in perfect health." (*Whytt's* Works, p. 603.) Some curious examples of nervous asthma are given by Laennec in his Treatise on Diseases of the Chest. One patient was instantly seized with great difficulty of breathing on attempting to travel in one particular direction, and was instantly relieved on turning back. This happened repeatedly. Another, an old asthmatic, subject to slight catarrh, was invariably seized with a paroxysm if his lamp happened to go out during the night, although he was asleep at the time. (De l'Auscultation Méd.) A singular instance of the influence of the nerves in producing asthma, without any local disease of the lungs themselves, is furnished by a curious affection prevalent in the east among persons addicted to the abuse of opium. It is a kind of spurious or factitious asthma, which attacks opium-eaters on being suddenly deprived of their habitual dose; in the same manner, and, no doubt, for the same reason, that delirium tremens attacks the spirit-drinkers of colder climates. The patient is seized with extreme breathlessness, exactly resembling that of asthma; the countenance being haggard, the pulse rapid, and the eye such as we should expect to find in a patient affected with phrenitis. If the disease is not relieved, it proves fatal in the course of a few hours. Some opium given in time will immediately relieve all the symptoms. (*Henderson* in Edin. Journ. vol. xxiv. p. 51.)

For the sake of those who are curious in nosological arrangements, rather than as being of any practical value, the following classification of the various cases which come under the head of nervous asthma is submitted to the reader.

1. In a very small proportion of these cases we cannot detect any disorder of the system, general or local, which can be considered as at all influencing the occurrence of the paroxysms. These may be termed cases of *pure nervous asthma.*

2. In an infinitely larger proportion of cases we find more or less of disease in the system generally, or in some of the principal organs; and which disease appears to be the remote cause of the paroxysms, influencing the bronchial muscles indirectly through the intermedium of the brain. Such cases may be termed *sympathetic nervous asthma.* This order may be subdivided into species, according to the nature or site of the affection which constitutes the remote cause of the paroxysm. For an account of these we refer to a subsequent part of this paper, where they will be noticed under the head of *predisposing causes.* It could lead to no useful end to notice them here in detail.

3. In a third group may be included, under the name of *symptomatic nervous asthma,* (1) those cases which depend on diseases immediately affecting the pulmonary nerves themselves, and (2) those in which the paroxysms are directly induced by organic disease of the lungs, head, pleura, &c. Of the former kind there are various examples to be met with in authors. In a case of asthma related by Ferrus, a large ossification was found in the centre of the pulmonic plexus, and which compressed some of the nerves. (Dict. de Méd. tom. iii. p. 109.) In a case of fatal dyspnœa, Beclard could discover no cause of the disease but a tumour on one of the diaphragmatic nerves. A nearly similar case is recorded by Andral (Dict. de Méd. Prat. tom. iii. p. 109.); and Parry mentions a case of "dyspnœa occurring by fits of aggravation, and at last proving fatal, without any symptoms of local pneumonic disease," in a person who had "thickening about the upper part of the vertebræ of the neck, with some degree of distortion, from venereal affection." (Posthumous Works, vol. ii. p. 16.) The influence of spinal irritation in producing palpitation and other irregular action of the heart, is well known; and we apprehend that many of the chronic dyspnœas and irregular asthmatic affections which we meet with in persons who are deformed, arise as frequently from disturbance of the spinal marrow produced by the distortion, as from disease of the lungs themselves.

The second subdivision of this group of cases includes those fits of spasmodic dyspnœa which so frequently accompany diseases of the heart, hydrothorax, &c. Although such affections may come within the logical definition of asthma in as far as the spasmodic condition of the bronchi is concerned, (and they are, therefore, alluded to in this place,) it would be to confound all rational principles of pathology to consider them as such in practice. They may very properly be named *spurious asthma;* but the consideration of their nature and treatment belongs to another place. (See Dyspnœa, and the articles which treat of the diseases of which they are incidentally symptoms.)

II. *Catarrhal Asthma.*—In studying the various cases of asthma met with in practice, while we find, in the vast majority of instances, some fixed affection of the bronchial membrane, we find great variety in the nature, and still more in the degree of this affection. In one class of cases there seems to be merely some peculiar modification of the sensibility of the bronchial membrane, which renders it susceptible of being excited to morbid action by various external influences. In others, however, and in an infinitely larger number, there exists either an habitual catarrh of a formal character, or such a predisposition to be affected by catarrh, as practically to amount to a like condition of the parts. In many persons thus circumstanced, there is such a susceptibility to be affected by cold, and to catch cold, that they can scarcely ever be said to be free from it. The least change of dress, the slightest draught of air, the most trifling dampness of shoes and stockings, or even standing for a minute on a stone floor, will give an instantaneous chill, and produce an immediate and sensible change in the condition of the bronchial membrane. In many persons this morbid susceptibility to cold, fostered and perpetuated as it is by improper management, arises to so great a height as to be extremely inconvenient. In the case of persons in easy circumstances, we sometimes see the susceptibility to cold so great, or so exaggerated by the hypochondriacal apprehensions of the patient, that life is almost devoted to the one object of escaping cold; and it must be owned, with very indifferent success.

Although very great susceptibility to cold, and to be affected by catarrhal affections, may undoubtedly exist without any discernible fixed affection of the bronchial membrane, yet this is only in the earlier stages of such states. Sooner or later, and generally very soon, the mucous membrane becomes disordered permanently; and it is this local disease of the lining membrane of the air-passages, together with the general liability to be affected by slight degrees of cold, which constitutes the most common state of persons subject to asthma. Between the extreme limits of this bronchial affection, from mere increase of sensibility up to the most acute inflammation, the degrees of shades are infinite. We can only in this place allude, and briefly, to the most marked of these. For fuller histories of these affections, we must refer to other articles in this work, particularly to Bronchitis, Catarrh, [Pulmonary] Emphysema, &c.

The catarrhal affections with which the asthmatic spasm may be combined may be either *acute* or *chronic.* As being by far the most common, we shall notice the chronic varieties first. Indeed, we shall only notice the acute forms in compliance with general custom, as we wish our observations in the present article to be considered as applying almost exclusively to a disease of a chronic nature.

1. The first variety of the chronic catarrhal asthma which we shall notice is ranged under the present head more from analogy than from any certain proof of its being essentially of a catarrhal nature. Its essential characteristic seems to be a peculiar morbid sensibility, or irritability of the membrane *lining* the bronchi, rather than any sensible physical alteration of it. If a name is desired for it, it might, in the language of Laennec, be termed *latent catarrhal asthma.* No doubt, if our means of investigation were sufficiently minute, we should find a physical cause in the membrane itself for the morbid irritability exhibited by it on the application of certain stimuli; but as our senses do not enable us to detect any such cause, we must content ourselves, for the present, with noticing the resulting phenomena. We are disposed to infer that the affection of the membrane is of the catarrhal kind; — firstly, because, in incipient catarrhs, we have often the same susceptibility of the membrane, without any other symptom of catarrh; secondly, because the asthmatic or dyspnœal paroxysm, in the cases now under consideration, frequently terminates in acute catarrh; and thirdly, because this state of morbid sensitiveness almost always degenerates, eventually, into some of the forms of chronic catarrh. In its progress, the first stage is the dry catarrh, and this soon passes into emphysema.

This peculiar irritability of membrane in many cases continues perfectly latent until rendered manifest by the application of certain stimulants. Some individuals are affected by only one kind of substance, others by two or more. Ipecacuanha seems the substance which, of all others, exerts the greatest influence in cases of this kind. Every practitioner of experience must have met with individuals in whom this idiosyncrasy was so strong that they could not remain in the same room in which a vessel containing powdered ipecacuan was opened, even at a distance from them, without becoming immediately affected with a paroxysm of dyspnœa more or less resembling asthma. We have ourselves known some cases of the kind, and have had several others pointed out to us by medical friends, in our own neighbourhood. Other persons, not affected by ipecacuan, suffer similar inconvenience from other substances in a state of minute diffusion in the atmosphere; such as the smoke of sealing-wax, the effluvia from hay, the fumes of chlorine, carbonic acid gas, &c. &c. In some of these cases, the dyspnœa passes off speedily; in others it lasts a considerable time; and in some it terminates in formal catarrh.*

2. The next variety of catarrhal asthma is that which is complicated by the disease termed *dry catarrh* by Laennec. It may, therefore be denominated *dry catarrhal asthma.* It is, perhaps, the most common form of asthma. For an account of the pathology of the catarrhal affection, we must refer the reader to the article which is specially devoted to it. It will be there seen that the progress of this affection inevitably leads to the morbid dilatation of the terminal bronchi or air-cells; a pathological state denominated pulmonary emphysema by Laennec. As the asthmatic paroxysms seldom occur in an early stage of the dry catarrh, it very generally happens that the emphysematous condition of the lung coincides with this variety of asthma, a combination which explains the results of the exploration of the respiration in this disease, noticed in the beginning of the present article. The co-existence of emphysema with asthma must be looked upon as of most unfavourble augury in relation to the cure, as the former disease, when once fully formed, is hardly susceptible of cure. In the variety of asthma dependent either on the dry catarrh simply, or on this combined with emphysema, the precursor and immediately exciting cause of the paroxysm, is almost invariably a fresh attack of cold, or, at least, some aggravation of the habitual catarrhal state.

3. The next variety of catarrhal asthma is that which is combined with the common chronic mucous catarrh. It is the *humoral asthma* of the old authors. In conformity with the names given to the preceding varieties, it may be denominated the *mucous catarrhal asthma.* This form of catarrh is occasionally the consequence of those last described; but it is still more frequently produced by repeated attacks of the acute catarrh. It is the common chronic catarrh, frequent in old age, and by no means uncommon in youth. It is often the sequel of acute bronchitis, and is, indeed, itself only a form of the same disease in a chronic state. Although the asthmatic paroxysm frequently supervenes to this state, our own experience inclines us to believe that it complicates still more frequently the latent and dry forms of catarrh. Individuals subject to the chronic mucous catarrh are frequently said to have fits of asthma when their habitual dyspnœa is merely increased by the supervention of a fresh cold, or by the aggravation of the habitual chronic inflammation from any other cause. No doubt such attacks are often accompanied with a slight spasmodic constriction of the bronchi; and therefore they are, strictly speaking, entitled to the name of asthma: but paroxysms of sudden dyspnœa, in which the spasmodic affection is the most conspicuous phenomenon, are certainly not very common; indeed, they must be considered as very uncommon, when viewed relatively to the extreme frequency of chronic mucous catarrh.

The preceding are the chief affections of the bronchial membrane, of a chronic kind, with which the asthmatic paroxysm is complicated. There are some others of an acute character yet to be noticed, and which, when co-existing with the paroxysms of asthma, entitle this to the name of the *acute asthma.* Two forms of this species are met with in practice, sometimes sufficiently well marked to be readily distinguished; but frequently, like the other species of asthma, so intermingled as to render the discrimination impracticable.

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* See a case of this kind in Parry's Posthumous Works, vol. ii. One of the most interesting examples of this peculiar effect of ipecacuan is the case recorded by Dr. Scott in the Philosophical Transactions for 1776. The patient was the wife of an apothecary, and became subject to regular attacks of asthma after her marriage. For some years no particular cause was suspected; but it was at length discovered that the paroxysm invariably came on when ipecacuan was powdered in the shop. This practice was accordingly discontinued, and she continued well eight or ten years; until one day, when her husband again brought home some powdered ipecacuan, and opened the packet in order to put the drug into a bottle, "his wife not being far off at the time, and in perfect health." This occasioned a most violent fit of asthma, which lasted eight days, becoming better during the day, and much worse at night. This patient's fits from ipecacuan usually lasted a few days, and went off commonly by an expectoration of viscid mucus. *Quere,* As most of the cases of asthma from ipecacuan have occurred in people connected with drugs, are we to conclude that the peculiar idiosyncrasy is much more general than is supposed, and is not evinced only because *other* persons do not come in contact with this drug?

1. The first of these two varieties may be termed the *acute congestive asthma.* Were it not that we frequently see the most extensive inflammation and consequent tumefaction of the bronchial membrane, without very great difficulty of breathing, certainly without any of that extreme and peculiar dyspnœa which characterizes the asthmatic paroxysm, we might agree with Parry in opinion that mere vascular congestion, from sudden determination of blood to this membrane, might account for all the phenomena of asthma. And there can be no doubt that, in a certain class of cases, this determination of blood is not merely the precursor of the spasm, but that it constitutes the greater part of the pathological condition of the affected parts. Of course, there is some modification of the nervous condition of the membrane previously to the afflux of blood to it; but it is extremely improbable that this modification is of a spasmodic nature: on the contrary, it can hardly be doubted that it is the morbid congestion of the blood-vessels which irritates the muscular fibres into spasmodic stricture. In this mode of viewing the case, (and the same observation is applicable to all the forms of asthma dependent on disease of the bronchial membrane,) we must regard the asthmatic paroxysm rather in the light of a contingency than as constituting an essential and necessary part of the pathological state. The nervous modification, the determination of blood, the vascular congestion, or catarrhal turgescence may exist without any spasm; and this may or may not supervene according as it is promoted or opposed by individual peculiarities of a general or local kind, the nature of which it is impossible for us to ascertain. The external phenomena will necessarily vary with the pathological condition of the parts; but it is probable that phenomena which appear to us similar may be the effect of different conditions. Thus it is probable that a paroxysm of like violence may equally follow an extensive congestion with a slight spasm, or a slight congestion with a great spasm; and all the various and relative modifications of which these states are susceptible will produce a great variety in the phenomena of the disease.

A strongly marked case of congestive asthma is recorded by Dr. Parry, in a person "who, without any previous disorder of the chest, died in fifteen or twenty minutes, with every symptom of spasmodic asthma;" and in whom, on dissection, the only morbid appearance observed was "a complete suffusion, of a damask-rose colour, amounting in some places almost to blackness, of the entire mucous membrane of the trachea, and of all the ramifications of the bronchia." (Parry's Elements of Pathology, § 474.) Cases so strongly marked as this are extremely rare. We are disposed to look upon them as analogous to that disease of the lungs termed, by Laennec, pulmonary apoplexy.

There is another form of congestion of the bronchial membrane, immediately dependent on disease of the heart, which is a common cause of dyspnœa in such cases, and is also sometimes the source of the asthmatical paroxysm. The state to which we allude is almost of a mechanical nature, being the direct result of impeded circulation. In certain habits the congested state of the bronchial membrane may produce simple dyspnœa, in others asthma; and in many it is at once indicated and cured by hæmoptysis. In most cases of this kind, the other mucous membranes, as well as the venous system generally, are overloaded with blood.

2. The last variety of catarrhal asthma which we shall notice may be termed *acute catarrhal asthma.* It only differs from the last in coming on more slowly, and in being complicated with a common catarrhal affection of the bronchial membrane, instead of a rapid congestion of the same. Reasoning *à priori*, one might expect cases of this kind to be very common. Such, however, is not the fact. The disease which has been termed the *hay asthma*, when amounting to that degree of paroxysmal violence deserving the name of asthma, belongs to the form now under consideration; although this affection is much more properly designated by the name of summer catarrh. In some cases of this kind, the dyspnœa is certainly considerable; in a small proportion of cases it is, according to Dr. Bostock, the only symptom: but we have not met with a single well recorded case in which the dyspnœa assumed the true asthmatic character.* In that class of persons, formerly noticed, in whom ipecacuan and certain other exhalations have the effect of producing great bronchial irritation, the difficulty of breathing is sometimes preceded by an acute catarrhal state of the membrane.

The two species of asthma last described comprehend those cases, of not very unfrequent occurrence, which were first particularly noticed by Millar under the name of the *acute asthma*, and which, on the continent more particularly, have very generally been since termed *Millar's asthma*, from this author. They also include many of the cases which have been described by authors under the name of suffocative catarrh, false croup, spasmodic croup, suffocative asthma, &c.; although many cases so denominated have been cases of pure bronchitis. It is hardly necessary to repeat what was formerly stated, that both these forms of acute asthma, more particularly the acute catarrhal asthma, are merely different shades of that extensive pathological state which comprehends all the forms of acute irritation of the mucous membrane of the lungs, from the slightest febrile turgescence up to the most violent inflammation. It is only the accidental complication of spasm that lends to it its peculiar features; and in our treatment we must never forget, that however prominent, or however (for the time) important this complication may be, it is only a consequence of a state yet more important. When the spasm is removed, we may have still a formidable disease to treat. It is truly remarked by Millar, that the acute asthma frequently lays the foundation for the chronic asthma. In the present paper we wish principally to confine our views to the chronic disease, which alone is properly termed asthma. The acute asthma more properly belongs to the articles which treat of the diseases of which it is merely a symptom.

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* See Dr. *Bostock's* Papers, Med. Chir. Trans. vols. x. and xiv.: also Dr. Parry's Posthumous Works, vol. ii.

It is hardly necessary to observe that two or more of the above forms of asthma, or rather of the above pathological states, may co-exist in the same individual. We may have the spasmodic paroxysm immediately excited by purely nervous causes, induced in persons already affected with disease of the bronchial membrane, while all the varieties of the symptomatic asthma may equally affect individuals who have or who have not such an affection of the membrane. We may even have organic disease of the heart, lungs, or pleura, together with disease of the bronchial membrane, and yet the immediate exciting cause of the asthmatic fit may be some irritation situated in a remote organ. In like manner, the acute forms of the disease may supervene to the chronic. All this complexity forms no substantial objection to the classification we have just given of the varieties of asthma. Our object is not to exhibit a specimen of logical nosology, according to the ancient approved method, but merely to lay before the reader such a catalogue of the varieties as he is likely to meet with in practice, founded upon differences in their pathology. If the student has once accurate views of the true nature of diseases, he will have little difficulty in discriminating all the varieties of them which it is of importance to know.

In referring to the preceding investigation, it may be useful to give a brief recapitulation of some of the principal points which seem established.

1. In the disease properly termed asthma, there is always present a spasmodic contraction of the muscles of the bronchi, and sometimes a similar state of the muscles of the trachea, larynx, and external muscles of respiration.

2. In a small proportion of cases, the spasmodic stricture may take place (idiopathically or symptomatically) without any previous disease of the affected parts.

3. In the great majority of cases, the spasmodic constriction is dependent on a pre-existing irritation of the mucous membrane of the air-passages.

4. Phenomena of a very similar character are sometimes the consequence of a congested state of the mucous membrane of the air-passages, without any attendant spasm.

5. The congested or tumefied state of the mucous membrane almost invariably accompanies the paroxysms, whether this state be a cause or a consequence of the spasm.

6. The violence of the paroxysms is modified no less by the degree of the congestion than by the degree of the spasm; a great congestion with slight spasm producing, probably, the same result as a slight congestion with a great degree of spasm.

7. In some cases, the tumefied or congested state of the bronchial membrane passes off entirely with the spasm, without any exhalation from the vessels or augmented secretion from the mucous follicles. More commonly there is a simultaneous relaxation of the spasm of the muscular fibres, and an exhalation from the mucous coat. This exhalation most commonly puts an end to the disease for a time; not unfrequently, however, the congestive passes to a more permanent state of inflammatory irritation, under the form of pulmonary catarrh or bronchitis.

Morbid Anatomy of Asthma.—In a complete history of asthma it would be necessary to give a full account of the state of the affected parts observed on dissection. In the present paper, however, we must content ourselves with a brief notice of some of the most common appearances. Various circumstances render this part of the history much less perfect than some may be prepared to expect. In the first place, asthma, strictly so called, scarcely ever leads to a fatal result in its early stages, and, therefore, few opportunities are found of investigating the pathological anatomy of it in its simple state. Secondly, in a certain proportion of cases, even if an opportunity were afforded of examining the affected parts in the early stage, if the opinions formerly advanced are correct, we ought not to discover any morbid appearances after death; any more, at least, than in hysteria, chorea, or other diseases of a purely nervous character. Thirdly, the parts principally affected in the asthmatic paroxysms are so minute, and have been hitherto so little examined in ordinary dissections, that it is not wonderful if they have often escaped notice, even when diseased. Fourthly, whatever may have been the pathological condition of the parts concerned in asthma, in the early stages, it is certain that the long continuance of the disease induces various organic changes in other parts; and it is often difficult to pronounce, with certainty, respecting the share which certain morbid alterations had in producing the phenomena of the disease. In the greater number of the recorded dissections of asthmatic patients, the morbid appearances are almost always to be looked upon either as the consequence of the disease, or as concomitant lesions, not more closely connected with the asthmatic paroxysm than as remote or exciting causes, and constituting no essential parts of the pathological state.

Willis gives a dissection of a person who had long been affected with asthma, and who died in a paroxysm. In this case, he informs us, all the viscera were sound, and among the rest the lungs, there being neither an accumulation of fluid in the bronchi, nor any stagnation of blood in the veins, (*Willis*, De Morb. Convuls. cap. xii. p. 94.) This must have been a case of pure nervous asthma, or of asthma dependent on the dry catarrh, the anatomical characters of which last named disease, when existing in its simple state, were unknown at the time this author wrote, and would hardly have been recognised if known. The probable fidelity of this dissection is, however, supported by the experience of the best modern anatomists. Laennec, when writing on the subject of nervous asthma, makes the following statement: "Even at the period in which we live, when the eyes of medical men are particularly directed to the minute investigation of the anatomical character of diseases, I have met with many cases in which it was impossible, after the most minute research, to find any organic lesion whatever to which the asthma could be attributed," (De l'Auscult. Méd.) Ferrus says that in fifteen years, almost entirely spent in hospitals, he has not met with a single dissection which could be fairly considered as exhibiting the results of simple or idiopathic asthma; and he adds that the still greater experience of Corvisart, Leroux, and Lerminier, leads to the same result, (Dict. de Méd. t. iii.) This statement is confirmed by Jolly, who informs us, that the results have been obtained by Andral, Bouillaud, Cruveilhier, Guersent, &c., (Dict. de Méd. Prat. t. iii. p. 608.) The last-named author relates two cases, in infants who died of "an acute remittent dyspnœa, with quick pulse, præcordial anxiety, and dry cough," in whose bodies no organic lesion whatever could be found, (Dict. de Méd. Prat. t. iii. p. 126.) Akenside gives an account of some cases of asthma, which proved suddenly fatal; in one of which, on dissection, nothing preternatural was found except a morbid redness of the lungs, (Med. Transact. vol. i.) In this case, although the phenomena of asthma appear to have existed during life, the patient's death, "suddenly at night, in a quiet sleep," is more like that from disease of the heart than asthma. Dr. Heberden gives the outline of the dissection of three cases, of what he terms asthma. One of these was evidently a disease of the heart. In the second case the thoracic viscera were sound, and no morbid affection could be detected, except an exostosis of the vertebræ. The third case was a well-marked example of pulmonary emphysema, (Commentar. p. 63.) This condition of the lungs, which must be considered as frequently a consequence, as well as a cause, of asthma, is noticed by many of the older authors, particularly Bonetus, (Obs. 57, 58,) Ruysch, (Obs. 19, 21,) Morgagni, (Epist. iv. 24; xviii. 14,) Stoll, &c. &c. It was, likewise, particularly described by our countryman Floyer, many years ago, as existing both in animals and man; being, in hawks, the cause of the *crocke*, a kind of dyspnœa produced by over-straining in flying; and, in horses, the cause of broken-wind, (Physician's Pulse Watch.)

The same condition of the lungs is, also, mentioned by Ridley, (Observ. Med. Pract. p. 219, 234. Lond. 1703,) Sir W. Watson, (Phil. Tran. Abrid. vol. xii. p. 145,) and others of our older writers. The dissections recorded in the work of Dr. Bree throw no light upon the morbid anatomy of proper asthma, as almost all his cases were mere symptomatic dyspnœas, produced by organic diseases of other parts. Dr. Baillie has given us accurate descriptions of all the varieties of emphysema of the lungs, but, unfortunately, we have no histories of disease to connect the lesions with asthma. We shall conclude this brief exposition with a notice of two cases by Andral, which appear deserving particular attention. One of these was a violent dyspnœa succeeding the retrocession of measles, and presented, on dissection, all the marks of bronchitis. In the other, which suddenly supervened to the drying-up of an old ulcer, and which might properly be termed acute asthma, the bronchial membrane was found reddened, in patches only, in small spots. Andral justly considers the inflammation, existing in this case, as inadequate of itself to account for either the symptoms or the fatal event, (Clinique Méd. t. ii. p. 72.)

Diagnosis of Asthma. — The diagnosis of asthma is seldom difficult. It is one of the diseases most readily recognised, and most familiarly named by the subjects of it, and by their friends. Still, as there are a few affections which have considerable external similarity with asthma, it will be proper briefly to notice them in this place. Systematic writers, indeed, supply us with a formidable list of diseases, which they say may be confounded with asthma; but to give any account of the distinctions between the greater number of them and it, would be only trifling with the reader. Even the few remarks we are about to make are intended much more for the student than for those who have had frequent opportunities of witnessing the diseases in question.

In the spasmodic affections of the glottis dependent on hysteria, the whole *facies* of the disease is very different from that of asthma. The somnolent languor, and frequently recumbent posture of the hysteric patient, contrast very strikingly with the awakened eagerness, the acute distress, and laborious voluntary exertions of the asthmatic. In spasmodic affections of the glottis from other causes, such as we meet with most frequently in children, but not often in them, there is a nearer approach to the external phenomena of asthma. In œdema, or in inflammation or ulceration of the glottis, in all of which there is more or less spasm combined with the fixed physical changes, an inexperienced observer might, at first sight, have some doubts respecting the nature of the disease. A closer examination, however, will soon remove all difficulty. In all the affections of the glottis and larynx, the patient recognises and points out these parts as the seat of his distress. In some there is acute pain, in all there is a marked and obvious sense of stricture there. The patient frequently endeavours, by handling the external parts, to relieve this stricture. He has the distinct feeling that the inlet is too small for the supply of air necessary to his well-being; and generally, he has the additional horror of impending suffocation from the progressive increase of the obstruction. Some of the most prominent symptoms are also very different in the two classes of cases. In the affections of the larynx, the sound produced by the passage of the air through the obstructed aperture is very peculiar, and very different from that which accompanies asthma, which latter is merely an exaggeration of the well known sound of simple wheezing. Almost all these observations apply, *mutatis mutandis*, to every partial obstruction of the trachea as well as larynx, whether such obstruction arise from foreign growths pressing on it, externally, from foreign bodies accidentally introduced into it, or from morbid formations within its cavity, as in croup.

Certain cases of severe bronchitis have likewise a considerable external resemblance to asthma, when first seen. In almost every instance, however, a minute examination of the various symptoms, or even the history of the attack, will speed-fly remove all doubt of the nature of the case. We do not here allude to that class of cases which were formerly noticed under the name of acute asthma, but to simple bronchitis, unaccompanied, or almost unaccompanied with spasm. In the cases termed acute asthma, there is, as we have seen, very frequently present an inflammation of the bronchial membrane; but this is in itself slight in degree, and bears, in relation to the sum of disease, only a small proportion to the vehement spasm with which it is accompanied. In affections of this sort, the immediate consequences of the spasm usually mask, and, as it were, overwhelm, the symptoms of inflammation, the countenance becoming haggard and shrunk, the skin cold and clammy, and the pulse incalculably quick and extremely feeble. It is, no doubt, unfortunate that such cases have been classed under the head of asthma at all; as there is reason to believe that the very name has had frequently the effect of diverting the attention of the practitioner from the only part of the disease which is really of much importance in a practical point of view. Against this danger, the judicious and experienced practitioner will be on his guard, and will be careful not to adopt such measures of treatment for the relief of the spasm, as may tend to aggravate the inflammation; and will sedulously watch the declension of the former, so as to be prepared to treat, when practicable, the more fixed and more important affection of the mucous membrane.

Very severe dyspnœa sometimes accompanies the more acute and pure forms of bronchitis; but there are strong and obvious lines of distinction between it and asthma. In the first place, the stricture on the chest and dyspnœa in bronchitis are very much less, and are also different in kind. In the inflammatory affection, the chest is still capable of considerable dilatation, even in the severest examples, which is never the case in the asthmatic paroxysm. Secondly, the usual symptoms of inflammation are present in bronchitis, a circumstance which never occurs in pure asthma.* Thirdly, the history of the attack will be found, on inquiry, to be very different in the two cases. Like all inflammatory diseases, bronchitis requires a certain space of time for its development, and it never comes to its acme suddenly as asthma does. Both may be forming for some time; but the invasion of the severe dyspnœa is in the one case gradual, in the other *per saltum*. In the fourth place, we may be allowed to state, for the benefit of the inexperienced practitioner, that a pretty accurate judgment may be formed of the nature of the case (unless in the very first attack) from circumstances quite extraneous to the disease itself. If the case is asthma, the comparatively composed and unappalled countenances of the patient and his friends, at once bespeak the consciousness of an attack which is neither novel nor dangerous. Their looks supplicate relief from suffering, not escape from danger. The state of things is very different in a severe attack of genuine bronchitis. The only other cases which we shall here notice, are those sudden and violent attacks of dyspnœa, noticed in a former part of this article, which frequently accompany different organic diseases of the thoracic viscera. These cases, as we there showed, may be logically, but not pathologically, ranged under the head of nervous asthma. They are more properly termed *spurious asthma*. The previous history of the case will, generally, suffice to point out the difference between attacks of this kind and true asthma; and where this is insufficient, proper attention to the actual symptoms and to the physical signs of thoracic diseases, will soon remove all difficulty. The diseases which commonly give rise to these paroxysms of spurious asthma, are, dilatation of the heart, contraction of the valvular orifices, hydrothorax, and certain other chronic affections which directly circumscribe the sphere of action of the lungs. It is fortunate that all these diseases have become of very easy diagnosis since the discovery of auscultation and percussion. In most cases the application of the stethoscope for a few minutes to the chest, or the employment of percussion for the same period, will remove all obscurity as to the nature of the affection. For details, however, we must refer to the articles which treat of those diseases individually, and to the general article on AUSCULTATION.

The prognosis in asthma needs no formal discussion. It may be gleaned from what has been already delivered on the pathology of the disease, and from the pathology of the diseases with which the paroxysm is complicated, or to which it leads.

Asthma hardly ever proves fatal as asthma, that is, in the paroxysm; but its frequent recurrence not merely aggravates the pathological states in which it has originated, but leads directly to the production of other diseases. The popular saying, which may be considered as almost proverbial, of *asthma being a charter of long life*, has probably originated in the natural disposition of the mind to exaggerate, beyond its true degree, any circumstance which has repeatedly turned out differently from what we expected. The most common of the diseases which originate in asthma, are emphysema of the lungs, dilatation of the heart, hydrothorax, and other forms of dropsy. For the prognosis in these cases, we must refer to the respective articles in the present work, which treat of the diseases individually.

If asthma is rarely fatal, it may be said to be almost as rarely cured, if this epithet is applied only to the entire and permanent removal of the disease. It is, however, frequently susceptible of great mitigation, and retardation of the paroxysms. On the whole, however, it must be admitted that there are few diseases less amenable to the interference of art. It has, consequently, ever been one of the marked opprobria of legitimate medicine, and an unfailing source of employment and profit to charlatans.†

Causes of Asthma.—In a former part of this paper we had occasion to give some account of

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[*] Almost all practical writers consider the presence of *fever* as sufficient evidence that the disease is *not* asthma. Thus Sydenham: "Notha hæc peripneumonia, licet ad asthma siccum aliquantulum accedat, tum quoad spirandi difficultatem, tum etiam alia quædam symptomata, ab illo tamen satis dignoscitur, cum in ista manifesta febris atque inflammationis signa se prodant, quæ in hoc nusquam comparent."—*Opera Universa*, p. 271.

[†] As far as relates to the *cure* of asthma, the prognosis cannot, perhaps, be summed up better than in the words of old John of Gaddesden.—"Et primo sciendum est, asthma in senibus non recipere curationem, nec in alia ætate nisi difficulter, maxime si sit antiquum."—*Rosa Anglica*, p. 220. August. Vindel. 1595.

the *causes of asthma*. The importance of the subject, however, renders some further details necessary. We shall notice, in order, first, the remote or predisposing, and secondly, the exciting causes.

I. *Predisposing causes.*—One of the most common predisposing causes of asthma is hereditary transmission; this disease, or the predisposition to it, being, according to our own limited observation, one of the most frequently inherited. Like other hereditary diseases, however, it often seems to affect rather an irregular course. In most of the cases the history of which we have investigated, while we have rarely failed to find some one of the near relations or progenitors of the patient subject to asthma, we have very often found the immediate parents to have been free from it. In some instances we have known a considerable proportion of the members of the same stock subject either to this or some other disease of the organs of respiration; one being subject to a chronic cough, another to permanent dyspnœa; one being liable to inflammatory attacks of the chest, and some having already fallen victims to consumption. A strongly marked case of hereditary asthma is one recorded by Sennertus, in the family of his wife. Her father, two brothers, a sister, and a sister's daughter, all laboured under asthma. (*Sennert.* Opera, tom. ii. p. 169.) We do not think that the phthisical constitution greatly predisposes to asthma. Malformation of the chest may, perhaps, be justly enumerated among the hereditary causes of asthma, as this configuration, or at least the predisposition which directly leads to it, is very frequently inherited. At all events, it must be admitted as one of the predisposing causes of asthma. [This probably applies rather to emphysema of the lungs than to asthma; and many of the recorded cases of asthma in young children belong unquestionably to emphysema.] Other peculiarities of structure of the respiratory organs, both connate and acquired, predispose to asthma, of which kind we may reckon narrowness of the glottis, (Dict. de Méd. Prat. t. iii. p. 599,) &c. And here also, perhaps, ought to be classed that peculiar morbid sensibility of the bronchial membrane, already noticed, which renders it intolerant of certain impregnations of the inspired air, more particularly ipecacuanha.

Several diseases predispose strongly to asthma, particularly chronic disorder of the stomach and bowels, gout, diseases of the skin, and uterine affections. Still more strongly and directly predisponent are all diseases which directly affect the bronchial membrane, namely, all the varieties of catarrh and bronchitis, measles, &c. Gout and diseases of the skin must likewise be enumerated as *exciting* causes, since their *suppression*, as it is called, is frequently followed by a paroxysm.* The same is true of habitual morbid discharges, whether of blood, as from the hemorrhoidal vessels, or of pus from old ulcers, whether natural or factitious. But, of all the predisposing causes of asthma, dyspepsia, in some of its forms or consequences, is by far the most frequent. Indeed, as several of the affections already enumerated as predisposing to asthma, such as chronic diseases of the skin, uterine and hemorrhoidal affections, &c., may, in a great majority of instances, be traced ultimately to dyspepsia as their cause, we may, without impropriety, set down to the score of this affection most of the cases of asthma which are usually said to originate from the above-named diseases. It is only, however, in what may be termed *secondary dyspepsia*, or that general disorder of the system which is so often the consequence of long and continued irritation of the chylopoietic organs, that results of the kind now contemplated arise. In these cases the distribution of both the nervous power and the circulating fluids becomes irregular, while the fluids themselves become depraved. It is in this state of the system that those local congestions of blood take place, which constitute the first perceptible ground-work of the very large class of secondary diseases. If general plethora is present in cases of this kind, as it frequently is, then some form of gout, or local hemorrhage, or morbid increase of some natural secretion, is the mode in which nature seeks to relieve, and often does relieve herself when she is most oppressed. But it is more particularly in producing changes of structure or of secretion in the mucous membranes of other parts, that chronic disease of that of the intestinal canal exerts its vicarious power. It is in this way that the bronchial membrane sometimes suffers singly, sometimes conjointly with that of other parts, more particularly with that of the uterus and vagina in females.

Many other predisposing causes are mentioned by authors, such as simple plethora, corpulency, erysipelas, suppressed perspiration of the feet, &c. No doubt all these are justly accused, particularly the first; but we can do no more here than refer to them.

But of all diseases which predispose to asthma, inflammatory and catarrhal affections of the bronchial membrane are by far the most frequent and effective. Other diseases may be said to predispose indirectly, but catarrh directly. In this class of causes we include measles and all the acute eruptive diseases, as likewise fevers, which are so frequently attended by catarrhal affections of the bronchial membrane. Many asthmatic patients date the commencement of the cough, which eventually, after many years perhaps, terminated in asthma, from the measles or small-pox, or some severe fever. These diseases had left behind them that permanent catarrhal affection of the bronchial membrane, which we have formerly shown to be the ordinary groundwork of asthma. The same results follow from repeated attacks of common catarrh. In some of these last it would, perhaps, be more correct to go a step further back, and state the predisposing cause of asthma to be an extraordinary susceptibility to the impression of cold, rather than the catarrh itself, which is the consequence of this susceptibility. The most common cause of this morbid sensibility to cold is to be found in the luxurious habits of later times, which have carried to a dangerous excess the comforts of our dress and habitations. In nothing is there a greater contrast between us and our ancestors than in the luxurious closeness and warmth of our apartments; and it will scarcely be denied that the result of such a mode of living has been to render us more easily affected by the rigour and changeableness of the climate out of doors, which, unhappily, appears rather to have retrograded than improved, while the endless invention of new modes of defence in our domestic arrangements, has made the contrast still greater. No author has dwelt so much on the consequences of these luxurious habits in predisposing to asthma, as Withers, whose observations are most pertinent, and well merit the attention of the reader. (See his Treatise on Asthma.) It is frequently by inducing this sensibility to the impression of cold, and by thus predisposing to catarrh, that dyspepsia lays the foundation of asthma. Many other of the remote causes of asthma operate in the same manner, and among these, certain mental states, particularly the depressing passions. Sedentariness and seclusion, the natural consequences of grief and melancholy, give rise to dyspepsia, and dyspepsia induces the languid circulation in the skin, extremities, and mucous membranes, which seems to be the immediate cause of the increased sensibility to cold.

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* "Proh Deum immortalem! (exclaims Schneider) quam multi arthriticorum asthmate seu suspirio extinguuntur!" It is to be observed, however, that Schneider, like most writers before the time of Willis, confounded all the diseases of the heart, &c. producing paroxysms of dyspnœa, with asthma properly so called. This author, referring to *gout* as a great predisposing cause of such attacks, quotes a good saying of Dunetus to a certain prince:—

> "Quand vous aves le goutte vous estes a plaindre
> Quand vous ne l'aves pas, estes a craindre."

II. **Exciting causes.**—Under this head must be comprehended all such circumstances as have been known immediately to induce a paroxysm, whether in the predisposed or not. These are extremely numerous and various. Joseph Frank alone enumerates upwards of forty, and it is but justice to this learned and indefatigable writer to state that he gives his authority in every case. (Prax. Med. Univ. Pars ii. vol. vii. p. 386.) Our countryman Willis, in general and more pithy terms, conveys nearly the same information when he informs us that "asthmatics can bear nothing violent or unusual. From excess of heat or cold, from any great bodily exertion or mental emotion, from change of season or of weather, from errors, even of a slight kind, in the non-naturals, and from a thousand things besides, they fall into fits of dyspnœa."* By far the most common and most important of these cases, we consider to be the application of cold, or, at least, one or more of those circumstances, whatever they may be, which, in ordinary cases, produce catarrh. Although it will appear from what is gone before that we do not deny the existence of cases of asthma of a purely nervous kind, and altogether independent of any permanent local affection of the bronchial membrane, we are decidedly of opinion that they constitute an extremely small proportion of the cases met with in practice. And we are further of opinion that out of the immense majority of cases of asthma from other causes, nine-tenths are complicated with some form of catarrh, or, at least, with a morbid susceptibility of the bronchial membrane to be affected by cold. In this very numerous class of cases, then, all those circumstances which induce catarrh, and which may generally be considered as some form or modification of cold, applied to the whole body or to a part of it, must be understood to be the usual exciting causes of the asthmatic paroxysm.

[Yet in regard to the exciting causes, there are some which induce asthma, and can scarcely be considered amongst the causes of catarrh. In general, a cold and dry air suits the asthmatic, but there are singular differences in this respect. Closing a door has been known to bring on a paroxysm; and, with some, darkness increases the violence of the attacks. One cannot bear smoke; another exists better in a smoky apartment. (Dunglison's *Practice of Medicine*, 2d edit. i. 327: Philad. 1844.)]

All practical writers on asthma lay great stress on this exciting cause, but none with such precision and effect as Withers, Ryan, and Watt. The latter author in particular, in a short but most valuable essay published in his Treatise on Diabetes, has very strikingly and beautifully illustrated the subject. In several cases there recorded, he has pointed out, with the greatest minuteness and perspicuity, the gradual influence of the cause, from the first impression of the cold up to the invasion of the paroxysm. (Cases of Diabetes, &c. p. 254. Glasgow, 1808.) Ryan had previously made the same observation, and applied it to practical purposes of the greatest importance. (Observations on Asthma, p. 40. London, 1793.) In these opinions our own experience leads us fully to concur; almost every case of asthma which we have met with being traceable to the usual causes of catarrh, and most of them being advantageously treated only on the principles which regulate the practice in that disease.

Treatment of Asthma.—In this, as in other diseases, the attainment of a just pathology would wonderfully abbreviate the labour of therapeutical prescription. In the writings of the older authors, who were, in general, guided either by empirical views or by fanciful theories of disease, we find no end to the array of medical formulæ, until every thing that had been put on record by their predecessors, or had been imagined by themselves or their contemporaries, as useful or likely to be useful in the individual disease under consideration, has been displayed at full length. In our own days, and in the diseases of the nature of which we have acquired some accurate views, a few general precepts will convey to those acquainted with the general principles of therapeutics all that we have to deliver respecting the treatment of a disease. We have not yet attained, in the case of asthma, to a pathology perfect in all its parts; yet we trust that enough has been recorded in the preceding pages to permit us to be more brief in the delivery of our practical precepts than some of our predecessors.

In entering upon this part of our subject, it is desirable that the reader keep constantly in mind that almost every thing in the succeeding pages respecting the treatment of asthma applies exclusively to the chronic forms of that disease. It will be recollected that the disease termed acute asthma is either a variety of bronchitis, or a violent congestion of the pulmonary mucous membrane, and that it is to be treated on principles applicable to such pathological states, with little regard to the spasm which complicates it. For the proper treatment of this affection we must, therefore, refer to the articles BRONCHITIS and CATARRH.

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* Asthmatici nihil violentum aut inassuetum ferre possunt: à frigoris vel caloris excessu, a vehementi quovis corporis aut animi motu, ab aeris aut anni mutationibus quibusque magnis, ab erratis vel levioribus circa res non naturales, imo propter mille alias occasiones in dyspnœæ paroxysmos incidunt. — *De Medicam. Oper.* p. 209.

The treatment of asthma, like that of all periodic diseases, consists of two parts, that proper in the paroxysm, and that in the interval. We shall notice these in the order now mentioned.

I. *Treatment in the Paroxysm.*—The simplest mode of proceeding, and that which will lead to least repetition and circumlocution, will be to notice the treatment under the head of the different remedies or classes of remedies which have been employed, or which may seem worthy of being employed.

Bloodletting. The extreme suffering of the patient in the asthmatic paroxysm will very naturally suggest the employment of so powerful a remedy as bloodletting. This is, accordingly, one of the measures which the young practitioner is almost sure to have recourse to upon being first called to a severe case. Experience, however, will inevitably lead to opinions less favourable to its use than might be anticipated before a sufficient trial of its efficacy. It is, no doubt, a very proper remedy in some cases; but it cannot be recommended as one that is generally either useful or safe. It may be occasionally necessary as an auxiliary to other means, or as a measure of precaution against the ill consequences likely to be produced by the paroxysm on other parts; but it should never be looked upon as a measure to be had recourse to, like many others, on almost empirical principles. It is a remedy too important to be trifled with. It never, we believe, puts an end to the paroxysm, much less does it cure the disease; and its habitual employment in an affection of frequent recurrence cannot fail to be highly injurious. It is indicated in the early attacks of young and robust subjects; in cases of great general plethora; in fits of great violence, in which the pulmonary circulation is much impeded, and the brain or other important organs are likely to suffer in consequence. Cases of this kind are denoted by the extreme violence of the dyspnœa, lividity of the face, stupor, &c. Bleeding with leeches is never proper in the asthmatic paroxysm; cupping may be occasionally useful, especially when there exists much cerebral congestion.

Narcotics, anti-spasmodics, &c.—Medicines of this class seem particularly indicated by the obviously spasmodic character of the paroxysm, and by its violence;* and accordingly they have been very generally prescribed in it, in one form or other, from the earliest times. It must be admitted, however, that the success of such remedies has been very limited, and the practice but little trusted to by experienced persons, whether practitioners or the subjects of asthma. In the great majority of cases in which opium and the medicines termed anti-spasmodics have been employed, they have failed to afford any relief; while in many they have proved injurious, either at the time or in their subsequent effects. A little reflection on the pathology of the disease will readily explain this result. In most cases the only portion of the disease which such remedies are calculated to relieve, (the spasm,) is conjoined with and dependent on a pathological condition of the bronchial membrane over which they have little or no control. This condition, if not positively inflammatory, is certainly of an analogous kind, and the experienced reader need hardly be reminded of the inutility (to use no stronger term) of anti-spasmodics in other cases of spasmodic stricture dependent on inflammatory irritation of the part, until this primary irritation has been reduced by remedies of another class. It is only in cases of pure nervous asthma, or in those symptomatic dyspnœas, simulating asthma, which depend on organic disease of the heart, &c. that opium and other narcotics and anti-spasmodics are at all likely to prove useful; and it is only in these cases that they should be prescribed. In the hysteric asthma the good effect of opium was long ago recognised by Willis,† and we have ourselves seen it very successful in the spurious forms just mentioned. In the true catarrhal asthma we have never seen it useful, and have often seen it injurious.

Stramonium.—This medicine had formerly been strongly recommended by Stoerk and others in mania, epilepsy, &c. but experience of its inefficacy had long occasioned its discontinuance in such cases, when its use was again revived in English practice in the beginning of the present century, as a remedy for asthma. It had been previously employed in India in the same disease with much reputation, and it speedily attained great fame upon its introduction by Dr. Sims into this country. Since that time it has been very much used; and although its virtues are found to be greatly less than was at first believed, they have been satisfactorily proved to be such as to entitle it to the first rank among the temporary remedies of asthma. The mode of its administration is smoking it during the paroxysm, in the manner of tobacco. Considerable difference obtains among patients in this respect. Some merely take the fumes into the mouth; others endeavour to draw them into the lungs; while others not only do this, but likewise swallow the smoke and the saliva impregnated with it. It is obvious that the dose is very different in these cases respectively, and may be expected to have a different result. The most common immediate effects of stramonium thus employed, are, a sense of heat in the chest, followed by expectoration, slight vertigo, or drowsiness, and sometimes nausea. In some cases the relief is almost instantaneous, the patient feeling the constriction of the chest removed after a few minutes, and his sufferings lost in refreshing sleep. In other cases it entirely fails to afford relief, and in some it decidedly aggravates the dyspnœa. Sufficient attention has not been paid to discriminate the particular cases in which these opposite results have been obtained, but it is probable that the explanation given with regard to the more common narcotics may apply here.

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* In quibusdam (says Poterius, speaking of asthma) tanta est morbi ferocia ut a laudano incipere *cogamur. Peter Op. p.* 301. *Francfurti*, 1698,

† Pro subita dyspnœæ mere spasmodicæ sedatione, nullum præsentius remedium expertus sum laudani opiati tincturâ nostrâ. *Willis Opera, loc. cit.*

When the cases are better selected, its good effects will probably be more certain. Fatal effects have unquestionably resulted from the employment of stramonium in asthma; but when we consider, on the one hand, that it is truly a medicine of great influence over the nervous system, and, on the other, that it has passed almost entirely from under medical supervision into the hands of the unprofessional public, it seems unreasonable to condemn it on this account. Now that the enthusiasm inspired by novelty and hope has subsided, and full time has been given to trace its failures as well as its triumphs, stramonium has perhaps fallen in public estimation as much below its real value as it was formerly raised above it. It was at first "the matchless specific," "the divine stramonium," and seemed to its delighted votaries almost like another elixir vitæ. For instance, we have the following account of it from Mr. Sills, a respectable merchant in London, who was one of the first to use it. In describing his own case, he says, "The fits generally continued, with short interruptions, from thirty-six hours to three days and nights successively, during which time I have often, in the seeming agonies of death, given myself over, and even wished for that termination of my miseries." He made trial of the stramonium, and then he writes thus: "In truth, the asthma is destroyed! I drink beer, eat of every thing; and if my mind was as free from perplexity as my body is from asthma, I would again enjoy my existence. I never experienced any ill effects whatever [from its use], and I would rather be without life than without stramonium!"[*] Alas for physic! that so many of our fondest hopes respecting its attainments must ever and anon be blighted by time and experience!—that so many remedies, deemed matchless on their first introduction, must now be ranged with the great mass to which no higher praise can be justly awarded than that they are *occasionally useful when judiciously applied!* With this limited fame, stramonium may take its place among the best remedies for the asthmatic paroxysm.

[A friend of the writer, who suffers excessively under the disease, frequently makes manifest to his medical attendant the relief he derives from the smoke of stramonium. For this purpose he employs the dried stalk. Others use the root; and others again the leaves only. (See the writer's *General Therapeutics and Mat. Med.*, i. 220: Philad. 1843.)]

Tobacco has also been much employed by asthmatics, either in conjunction with stramonium, or by itself. It is considered in general as beneficial in the paroxysm, and, in the estimation of some old asthmatics, its effects are not inferior to those of the former medicine. Neither seems productive of relief unless expectoration is excited.[†]

Lobelia Inflata.—This new medicine has for the last few years more than rivalled stramonium in public estimation; but we consider its pretensions to rest on much slighter grounds. It has certainly been occasionally productive of great and immediate relief, but has much more frequently failed altogether; and in cases where it had at first succeeded, it has lost its efficacy on repeated trials. We have found it occasionally beneficial in checking the paroxysm even in cases of catarrhal asthma, if given at the very commencement; but have found it more certainly successful, at least temporarily, in spurious cases produced by hydrothorax and disease of the heart. Further trials are necessary to enable us to speak confidently of its real merits. It is given in the form of a saturated tincture of the leaves, in doses of from half a drachm to a drachm and a-half, or two drachms.[‡]

In reference both to this medicine and stramonium, we must remark that, as their great powers are unquestionable in relieving the asthmatic paroxysm in certain cases, we suspect that our frequent failures arise from our own misapplication of the remedy. There is every reason to believe that there is one particular class of cases, to which such medicines are applicable; and the attention of practical physicians cannot be better employed than in endeavouring to discriminate them. This is a task which does not seem very difficult, and which we do not, therefore, despair of seeing accomplished.

Coffee.—This dietetic medicine has obtained considerable reputation in asthma. We are informed by Sir John Pringle, that "Floyer, during the latter year of his life, kept free from, or at least lived easy under his asthma, from the use of very strong coffee." (*Percival's* Med. Essays, vol. iii. p. 270.) If this be true, the Knight of Lichfield must have found some difficulty in reconciling the utility of this "hot drink" with his theories, or even with his past experience. But, be this as it may, Sir John Pringle assures us, on his own authority, that coffee is "the best abater of the paroxysms of asthma" that he has seen. He says the coffee is to be made very strong, ("an ounce for one dish,") and the dose to be repeated every quarter or half hour. This practice is sanctioned by Dr. Bree, and has been much used since the publication of his Treatise. Our own observation and inquiries lead us to rank it with other narcotics and stimulants, and, therefore, to place no reliance on it as a general remedy.

Ipecacuan, Squills, &c.—Emetics are recommended by Floyer, Bree, and most of the older authors, as being useful in the paroxysm. Should this supervene to a full meal, there can be no doubt of such means being proper; or if it occur in a person having an habitually sluggish and loaded state of the stomach, there may be some benefit in giving a gentle dose of ipecacuan. But they are not generally useful; and in many cases they are decidedly contra-indicated by the state of the stomach. Akenside was a great advocate for the employment of ipecacuan. His practice was to give ℈i. in the paroxysm to induce vomiting, ("which," he says, "failed not to produce great and immediate relief,") and in the intervals to give *gr.* v. every morning, or *gr.* x. every other morning, which was also, he says, generally attended with vomiting, but sometimes only with nausea. This practice he recommended to be continued for a month or six weeks. He says the medicine proved equally beneficial, whether it produced vomiting or merely nausea. (Med. Transact. vol. i. p. 93.) It is probable that it would have proved still more successful, if it had produced neither. Ipecacuan is certainly a remedy of considerable power in the asthmatic paroxysm; but this seems altogether independent of its emetic properties. Practitioners of experience, without subscribing to the doctrine of *homœopathy*, will certainly think more favourably of it on account of its peculiar tendency to *induce* fits of asthma in the predisposed. Long before the time of Hahnemann, the main principle of his doctrine was recognised by practical men in the adage—*nil prodest nisi læditur idem.*

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[*] Communications relative to the Datura Stramonium. Lond. 1811.

[†] In a communication, with which we were recently favoured by an old and intelligent asthmatic, he thus expresses himself: "Smoking tobacco or stramonium is sure to give relief if it produces expectoration, and it will generally do so if the moment I awake [i. e. in the incipient paroxysm] I begin to smoke, and continue to do so for three or four hours. Smoking, I am able to say, after fifteen years' practice and suffering as much as mortal can suffer and not die, is the best remedy for asthma *if it can be relieved by expectoration.* I have been in the hands of all the doctors of —— for fifteen years, and still I say, *Smoke.*"

[‡] *Eberle's* Treatise on the Mat. Med. Philadelph. 1822. Cases by *Dr. Andrews*, Glasgow Journ. vol. i. p. 177.

Many practitioners are partial to the use of *squill*, which has the advantage of the personal suffrages of both Floyer and Bree in its favour. It is said to be most useful when it produces nausea or gentle vomiting. We have no experience of its effect that deserves notice.

Refrigerants. — Vegetable acids and neutral salts of a cooling nature have been considered beneficial by many, particularly nitre and vinegar.* Remedies of this class have one great advantage over many others that have been used in asthma, that they are not likely to prove injurious, and may prevent the administration of such as are. Combined with mild diaphoretics and small doses of ipecacuan, we look upon them as the safest, and perhaps, on the whole, the best, in the most common cases, namely, the catarrhal. Indeed, it remains yet to be proved if, in the majority of cases of asthma, medicine possesses any resources superior to those found most useful in simple catarrh.

Derivants, in the form of stimulant pediluvia, sinapisms to the feet, &c., are recommended, most particularly by foreign physicians. We have repeatedly tried the warm foot-bath. In some cases it afforded relief; in others it immediately aggravated the dyspnœa.

[M. Ducros, of Marseilles, found ammonia, of the specific gravity .905, applied over that part of the cervical vertebræ which corresponds to the pharyngeal plexus, almost instantly arrest the paroxysm, in some cases; and Dr. Graves (*A System of Clinical Medicine*, Dublin, 1843,) has found the application of a liniment, which is an imitation of one used by a celebrated empiric — St. John Long—of much service. It is prepared as follows: —

℞ Acid. acet. fort. f.℥ss.
Ol. terebinth. f.℥iij.
Aquæ rosæ, f.℥iss.
Ol. limon. ♏ x.
Vitell. ovi, q. s. ut fiat mistura. To be applied by means of a sponge to the nape and side of the neck, and the forepart of the chest.

It generally induces an eruption of small pimples, after a few applications. Benefit has also resulted from dry cups, and from sinapisms to the chest and back; and as the modification in the circulation, produced by a ligature round the lower limbs, and the new condition thereby engendered, have prevented an attack of epilepsy, the same course has been advised in asthma. Cold affusions and aspersions have been used with benefit, under a similar view.]

In concluding this brief and somewhat contradictory exposition of the principal remedies employed in the asthmatic paroxysm, we need hardly point out the inference to which it leads, viz. that we have yet to learn a rational and consistent practice in this affection. Hitherto, remedies have been employed too much from empirical views; with little or no regard to the real pathology of the disease in general, or to the peculiarities of individual cases. What is most wanting in our treatment is due attention to these circumstances. The list of remedies given above contains a sufficient store of arms if we only knew how to wield them. For further information on this point, we can at present do little more than refer the student to the exposition of the pathology of the disease given above, and to the general principles of therapeutics.

There are, however, one or two points in the pathology of asthma which appear to us to deserve much more attention, in reference to practice, than they have hitherto obtained either from practitioners or patients; and respecting which we shall therefore say a few words. These points are, the very general production of the paroxysm by cold, or rather, by "catching cold;" and the identity of the very earliest stage of the disease—that is, the stage preceding the attack of actual dyspnœa—with that of common catarrh. If the invasion of this stage were carefully watched, and means were taken calculated to check its progress, it is not to be doubted that the asthmatic paroxysm might be frequently prevented. In Dr. Ryan's work this precursory stage of asthma is noticed, and its frequently inflammatory character recognised. "The appropriate remedies for such threatenings of asthma (he says) are bleeding and blistering, which have often to my knowledge warded off the impending attack." (Observations on Asthma, p. 40.) But it is in the Essay of Dr. Watt, formerly noticed, that this important part of the pathology of asthma has had justice done to it, and the principles of treatment to which it leads have been satisfactorily explained. In several cases there recorded, the patients are shown to have been able to recognise the approach of the paroxysm some considerable time before its actual invasion; and by adopting very simple measures "to check the cold," they frequently succeeded in averting the asthma for the time. Those measures were warm pediluvia, warm diluents, and diaphoretics on going to bed, and sometimes purgatives. If these means were followed by evacuations by the skin and bowels, the fit was almost certainly prevented. A circumstance mentioned by one of Dr. Watt's patients is well worthy of notice, as strikingly illustrative at once of the pathology and proper treatment of such cases. If the precursory symptoms of the attack had continued for a number of hours before the patient had recourse to the usual measures, these were found to be now worse than useless. "The bathing and warm drink, which, in the earlier part of the attack would have prevented the fit, serve now to bring it on sooner and with more violence." (Cases, &c. p. 248.) We recommend this practice to the particular attention of the profession, convinced from our own experience, as well as from that of the author just named, and from the soundness of the pathology on which it is based, that it will be found of the most essential benefit in asthma. The great uncertainty and lamentable feebleness of our therapeutic means, after the disease is fully formed, enhance extremely the value of any kind of treatment calculated to prevent the invasion of the paroxysm. We would in an especial manner recommend the employment of the *vapour bath* in this initiatory stage of asthma, as calculated to produce the best effects. (See the article Bathing.)

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* Ex traditis mihi ægris nonnullos vidi quasi mox stragulandos, nisi potui datum esset acetum aquæ frigidæ mistum. *Sir W. Fordyce's Fragmenta.*

II. *Treatment in the interval.*—It will be obvious to any one who considers the pathology of asthma, its different forms and complications, its various causes, and the important modifications derived from difference of constitution in the subjects of it, that the treatment of this disease, in the interval, must vary greatly in individual cases. Practical precepts, which can apply generally, must, on this account, be very brief. They can only have reference to the disease in its simplest state, whether this has been its original character, or has been brought about by the removal of its complications by previous treatment. When called on to treat any case, our first object will be to ascertain its peculiarities; and, having ascertained them, we must regulate our practice accordingly. If the paroxysms of difficult breathing appear to be unconnected with any very marked disorders of the system, except such as are considered to constitute an essential part of the disease, we may then proceed at once to apply the remedies which we consider best suited to the cure of asthma in general. If, on the contrary, we find, as will generally be the case, that the asthmatic affection is complicated with and apparently influenced by some disorder of other parts, it will be wrong to apply any remedies specially directed to the cure of the asthma, until these extraneous disorders are removed, or at least attempted to be removed. In a former part of the present article we noticed some of the most important of these complications under the name of predisposing causes. We need not repeat what was there delivered respecting their nature; and for their proper treatment, we must refer to the different articles in the Cyclopædia specially devoted to their consideration. We will only here remark that, however much their presence may modify the character of the asthma, and the treatment requisite in it, their co-existence with asthma will rarely interfere with the treatment which is found generally most successful in them.

It is requested that the reader will bear in mind the import of these remarks while perusing the remainder of this article.

On proceeding to the special treatment of asthma, the condition of the bronchial membrane will engage the first attention of the practitioner, as it is on the morbid state of this, in the great majority of cases, that the disease especially depends. If it is found that this membrane is the seat of any formal disease, our most strenuous and persevering efforts must be directed towards its cure or mitigation. The catarrhal affections which complicate asthma seem to possess no essential difference from the same diseases existing without asthma. Their treatment must, therefore, be the same; and as this will be given in other parts of this work, it would be to cause unprofitable repetition to notice it here. (See the articles Catarrh, *Dry*, *Latent*, and *Chronic;* also Bronchitis, and Emphysema of the Lungs.) On the present occasion we shall only advert, in a particular manner, to that point of the treatment which relates to the means best calculated to prevent the incessant aggravation of the catarrhal state by fresh attacks of cold. Our readers will be at no loss to understand the importance of this branch of treatment, since we have attempted to show that the renewal of the asthmatic paroxysm, in very many cases, depends on these attacks.

Cold bathing.—Of all the means calculated to lessen the morbid sensibility of the bronchial membrane to the impression of cold—in other words, to diminish the tendency in individuals to catch cold—there is none at all comparable to the application of water to the surface of the body, under some form or other of the cold bath.

In the article Bathing, the principles on which the cold bath operates will be detailed, as also its various forms, and the best methods of applying them in particular cases. On the present occasion we can only afford room for a few general observations.

In a climate so cold and variable as that of England, it is utterly vain for those who are unfortunately very liable to catarrhal complaints, to hope, by warm clothing, comfortable rooms, or any plan of seclusion from the atmospheric vicissitudes, to escape them. The very efforts such persons make to avoid the unfavourable influence of the climate only render them more subject to it. Here, as in the case of most other evils, moral as well as physical, the best chance of success consists in strenuous resistance. If we do not positively attack the enemy, we must at least, if we hope for safety, present a bold front and maintain a strong defensive.

It is only by the return to hardier habits generally, and by the practice of cold bathing, that the persons whose cases we are now considering, can hope to re-establish the natural harmony which ought always to exist between the animal and the climate it inhabits, and which in them has been unfortunately destroyed. Cold bathing may be used in various ways; in the form of the common plunge-bath, the shower-bath, or by simple ablution of the exposed surface. In the case of asthmatics, the latter is the mode generally preferable in the first instance, or else the tepid shower-bath. Ablution, when proper, has a very great advantage over all the other forms of bathing, in being attended with little trouble, and being accessible to all. The process consists in simply washing with a sponge, towel, or piece of flannel dipped in water, the trunk of the body, and then drying it, using strong friction at the same time. On first commencing the practice, if in winter, the chill must be taken off the water. A portion of common salt must be always dissolved in it, in the proportion of one or two ounces to the pint, or an equivalent amount of vinegar added. The time for using the water is immediately on getting out of bed; and this is also the best time for using the shower-bath, if the system is sufficiently vigorous to bear the shock without any further preparation. (See Bathing.) Both these processes may be used equally in winter; and to these, in summer, may be added bathing in the open sea. This last may be prolonged into the autumn, or even through the winter, with great advantage, if the power of re-action is sufficient; but the number of asthmatic subjects who can bear this is very few. Indeed, in prescribing the milder forms, some preparation will often be necessary, and in all cases the greatest care must be taken that the first application of the remedy does not induce an attack of cold; not, however, so much from any particular risk thereby occasioned, as from the effect such an event may have on the patient's mind. A severe cold, so caught, may entirely destroy all chance of benefit from the practice. Almost all our patients will be averse to the remedy; and when they can bring what they consider as *experience* in aid of their own strong prepossessions, what hope is there that they will listen to our recommendations?

In cases of extreme susceptibility to cold, we shall often find, on examination, that there co-exist with the asthma some form of dyspepsia, and a feeble and irregular distribution of the blood, particularly on the surface and extremities. In cases of this kind, before instituting the process of *hardening* by means of cold bathing, exercise in the open air, &c., it will often be necessary to employ measures which may at first seem of an opposite tendency. For instance, if the dyspepsia is dependent on an inflammatory or irritated condition of the mucous membrane of the stomach or bowels, low diet and a cooler regimen, and even repeated leeching may be necessary; and a course of warm bathing may be required, not only to assist in the cure of the dyspepsia, but to improve the condition of the skin, and invigorate the circulation generally, and particularly in the extremities.

When instituted after proper preparation, and gone about with due caution, it is often quite surprising how speedily the cold bath lessens the susceptibility to catch cold; and when strenuously and judiciously persevered in, conjointly with proper exercise and regimen, and the avoidance, as far as practicable, of the various causes which produced and fostered the morbid sensibility of the system generally, and of the lungs in particular, the benefit thence derived is often very remarkable. The appetite and digestion are improved; the circulation becomes more vigorous, with a corresponding increase of warmth in the extremities; and that internal sense of vigour and activity, which is always the source of agreeable feelings, is once more experienced. No longer shut up like an exotic in a stove, the slave of every season, the invalid is now enabled to go forth into the open air like his neighbours, and to take a share in the common business and pleasures of the world. Even in the cases where the results of this practice fall far short of those now described, the benefit is still most substantial, and such as, we are assured, can be derived from no other source.

The practice of cold bathing in asthma has not merely the sanction, but the express recommendation of almost all the authors who have treated professedly of the disease, and of most practical writers who have noticed it incidentally. Among the ancients, Cælius Aurelianus; and, among the moderns, Floyer, Withers, Millar, Ryan, Bree, are all strenuous advocates for the employment of cold bathing in some form or other. None of these, however, advocate the practice with such zeal as Ryan, whose treatise may be considered as almost entirely devoted to its recommendation.

Tonics.—The special medicines which have been most recommended and used in asthma, belong almost exclusively to the class of tonics. But before proceeding to notice these particularly, we must be permitted once more to caution the practitioner against their indiscriminate use, without due regard to the state of the system. Great discredit has been thrown upon many valuable medicines, and much injury done to asthmatic patients, by premature attempts to cure the disease by means of tonics, and other specific remedies, directed exclusively to act on the nervous system. This is, indeed, the besetting sin of British practice in chronic diseases; and we have good reason to know that asthma forms no exception to a rule too general. Medicines of a kind calculated to act with great power on the organ to which they are primarily applied, are frequently prescribed without any reference to the existing condition of that organ. If general debility prevails, and still more surely, if the stomach refuses to perform its functions with vigour, bitters, bark, steel, are immediately prescribed, with little or no regard to the state of the stomach, although this may be such as altogether to contra-indicate the use of such remedies. While active irritation or chronic inflammation exists in the intestinal mucous membrane, the true tonics are leeches, refrigerants, and low diet; and it is only after the recipient has been prepared by such means, that tonics can be administered without injury even, certainly with any prospect of benefit. We shall now notice, in detail, some of the principal remedies of this class that have been most employed in asthma.

Bark. — The well-earned fame of this noble medicine, in the cure of the periodical affections which originate in malaria, would naturally suggest its employment in a disease like that of asthma; and we find, accordingly, that it has been prescribed and recommended by almost every one who has written on this disease since the introduction of cinchona into European practice. Floyer says, that nothing is more likely to prevent the return of the paroxysm than bark; and that, even in the cases of symptomatic asthma, "though it cannot prevent the fits, yet it greatly relieves the sweats and faintness attending the fits, and headachs, and makes the intervals of the fits longer." Bree recommends it, but less forcibly. He says it acts as other tonics, and is inferior to steel. Ryan says that "there are few cases that will not admit of its use, particularly if the fits are kept up by habit;" but he adds, that his success with this remedy "has not generally answered his expectations." Laennec says, "when the paroxysms bear a strongly-marked periodic character, cinchona often diminishes their frequency, and sometimes stops them altogether;" but it does not appear clear that he here speaks from personal experience. The fact appears to be, that bark possesses no specific powers in checking the return of the common asthmatic paroxysm; but that it occasionally acts beneficially in two classes of cases; *first*, when the asthma is complicated with ague, as it sometimes is, and, *secondly*, when the stomach or general system is in a state in which a tonic of this kind is beneficial. If it improves the general health, it frequently aids in the cure or relief of asthma; and it need hardly be said that it will do so in the malarious complication. Cases of this last kind are mentioned by Withers, (Treatise, p. 412, et seq.,) Frank, (Med. Univ. ix. 407,) Heberden, (Commentar. p. 59,) and others. In many cases of asthma, however, we are convinced that bark is not merely useless, but decidedly injurious; and we are on the whole disposed to consider it as a medicine of very subordinate value in this disease.

Steel.—This tonic has been even more extensively used than bark, and, we apprehend, with more general success. In the cases which are attended by that cachectic state of the system indicated by more or less of the pale chlorotic aspect, this remedy is often extremely beneficial, by imparting vigour to the stomach and system generally. Bree is a great advocate for steel, which he considers as preferable to all other kinds of tonics. Floyer's experience, however, both personal and professional, is rather against the use of steel. He says, "Most asthmatics complain that steel heats them, stops their stomachs and breaths, and thickens the phlegm, and at last produces a severe effervescence which gives the fit." He says, that both himself and most of his patients were injured by the use of the chalybeate mineral waters, although some were better for them, "the quantity of cool water (as he simply observes) doing more service than the steel could do injury." The fact, no doubt, in this case, as in that of bark, is, that success or failure will depend upon the proper application of the remedy. If the general state of the system seem to indicate the use of steel, and if the state of the stomach and bowels do not forbid it, we have no doubt that it will often prove a valuable remedy in asthma; and the class of cases which are most likely to be benefited by its use, are either those which occur in what may be called the chlorotic temperament, or those which seem allied to neuralgic affections, not dependent on malaria, in which there can be no doubt that steel is often highly useful. But in any case it will be the particular condition of the digestive organs and the general system that will point out the propriety of the remedy, and not any supposed specific powers possessed by it against the asthmatic paroxysm. If it is contra-indicated by the presence of such circumstances as render it useless or injurious in other cases, the addition of asthma to the group will not in any way remove this contra-indication.

Oxyd of Zinc.—This medicine has obtained celebrity as a remedy for asthma, chiefly through the publication of Dr. Withers's treatise, in which it is strongly recommended, as possessing extraordinary powers in the cure of this disease. The author records many cases illustrative of its effects. In several it certainly appears to have been beneficial; but, like most promulgators of new or favourite remedies, he has greatly exaggerated its importance as a general remedy. Dr. Withers gave the medicine in doses, varying from five to twenty grains twice or thrice a day. This tonic may be given in states of the stomach when bark and steel are inadmissible; and certainly when tonics are indicated, it is entitled to a trial, from the ample evidence adduced in its favour. We are not entitled to recommend it from experience, having but seldom prescribed the remedy.

Numerous other medicines of the class of tonics have been employed in the cure of this disease, and have obtained much credit at different times from their employers. There is, however, hardly any which seems entitled to a distinct notice; as the principles above laid down must regulate their employment in individual cases, not (as was then stated) so much from the character of the asthma, as from the state of the general system and the digestive organs. Acids combined with bitters are greatly commended by Floyer, and he gives a formula for an oxymel, (p. 167,) by which he says he was frequently relieved, and his fits were kept off many months.

Depletory measures.—These measures, the very reverse of the last, have been recommended by various authors in the intervals, particularly local or general bloodletting, emetics, blisters, &c. In respect to this class of remedies, as to the preceding, it must be observed that they may be very proper in certain cases, but that the indications for their employment must be furnished by such states of the system as would render them proper independently of the asthma. This disease, considered simply, and exclusively of the morbid states with which it may be complicated, can hardly ever require the loss of blood, or render emetics proper; but if the subject of asthma is suffering from general or local plethora, or from any local inflammation, general or local bloodletting will no doubt be very proper: in certain forms of gastric derangement an emetic will be equally so; and it is very probable that the treatment will, in both cases, be found to alleviate the asthmatic paroxysms. Still we must not say that these measures are to be recommended among the general remedies of asthma. It is somewhat singular that purging is stated to be injurious in asthma by almost all our practical writers, even by such as rather recommend depletion in other forms. Judging from the frequency of the dyspeptic complication, and particularly of that form which consists in an irritable state of the mucous membrane of the bowels, (asthmatics are rarely of a costive habit,) we are disposed to believe that purgatives frequently prove injurious in asthma by increasing this irritation.

Mild aperients, however, are useful when indicated by a torpid state of the bowels and diseased secretions; and sometimes even pretty strong purgation is temporarily beneficial at least. One of our patients informs us that he took every day for ten weeks some secret medicine which had the effect of producing four or five copious watery evacuations daily, and that he remained free from his asthma during eight weeks of the time, a period much beyond the average length of his intervals. He thought, however, he was worse afterwards. Floyer says that purging frequently occasioned a paroxysm in his case.

Various forms of local depletion and of counter-irritation have been strongly recommended in asthma; and certainly on better grounds than several of the remedies already noticed. Issues, in particular, have been a favourite remedy with the majority of writers on asthma. They are, however, like most of the other remedies mentioned, indicated in most cases more by some morbid condition of the system co-existing with asthma, than by the asthma itself. They are found particularly useful in gouty habits, in cases succeeding to the drying-up of established discharges, natural or morbid, or the suppression of cutaneous diseases. In this latter case, various other counter-irritants have been recommended, and especially the re-establishment of the original disease, if practicable.[*]

Warm bathing has been found generally injurious in cases of asthma. Dr. Bree says it is hurtful in every species. He himself tried its effects both during the fit and in the interval, and found that in the former case the paroxysm was much aggravated, and in the latter it was induced in a few hours and at an unusual period. When this extreme sensibility to the warm bath exists, it is a very unfavourable circumstance, as the most frequent complication of asthma (the dyspectic) is so generally relieved by this very measure. Is it generally true that irritations of the mucous membrane of the intestines bear warm bathing well, while those of the bronchi bear it badly?

Expectorants.—The various medicines, many of them of very different qualities and modes of action, usually classed under this head, were formerly much employed in asthma; as often, however, we apprehend, from false theoretical views as from any evidence of their utility. From what has been above delivered respecting the pathology of asthma, it is obvious that the disease does not depend upon any accumulation of mucus or phlegm in the bronchi, nor yet upon the retention of this in the glands that secrete it, according to the theory of Bree. Any increase, therefore, of the excretory function of the bronchial membrane, if it could be induced, must be useless, in this point of view at least. There is, however, a most important class of cases in which the augmentation, or, at least, the alteration, of the bronchial secretion would be very beneficial; and if we possess any medicines capable of effecting this, without injuring, in other respects, the secreting organs, such medicines certainly must be deemed useful expectorants in this case. We allude to asthma complicated with the dry catarrh, in which we have at once a low degree of chronic irritation of the mucous membrane, and the secretion of a minute quantity of a thick gelatinous and extremely adhesive mucus, very capable, by its presence in the minuter bronchi, of adding mechanically to the difficulty of breathing. Do we possess any medicines capable of changing the secretory process whereby this morbid mucus is formed, so as to prevent its formation? If we cannot do this, have we any means of changing the character of the secretion, so as to render it more fluid or less tenacious? When secreted, whether more or less fluid, have we any means of accelerating its removal from the bronchi? If we possess the power of effecting any of these objects, are they attainable without any augmentation of the chronic irritation of the mucous membrane? The full discussion of these questions will naturally come under consideration in the articles which treat of the catarrhal affection of which the asthma is an attendant; we would only here observe that remedies of this kind are not to be applied until after the employment of the ordinary means calculated to lessen the irritation of the membrane, of which this secretion is the product.

The older authors did not doubt that they possessed in their *alterants*, *attenuants*, *incidents*, *deobstruents*, remedies calculated to diminish the consistence and tenacity of the blood, and of the natural or morbid products formed from it within the body. Numerous remedies were ranged under these various heads; being classed, generally, according as they were supposed to act chemically or mechanically. The chief of those which attained great celebrity were the pure alkalis, or the neutral salts formed from them, or the combination of the alkalies with oil, constituting the various kinds of soap. These remedies fell into disuse upon the overthrow of the humoral pathology, and some of them, probably, were unjustly condemned on account of the false theories by which their operation was explained in that system of medicine. Of late years the practice of administering the same remedies has been in a very considerable degree restored, together with a portion of the doctrines with which they were anciently associated; while some have adopted the practice without the doctrines. In the end of the last century Mascagni introduced the use of alkalis into the treatment of pulmonary inflammations, upon the principle of their attenuating or solvent powers, and, it is said, with great success;[†] and his practice has been zealously followed up and extended to other diseases by other physicians in that country, and with the greatest success, as is alleged.[‡] A practice somewhat similar had been previously adopted, in Italy, by Sarcone, (Istoria Ragionata, &c. Napoli, 1765,) and, more recently, Laennec has strongly recommended it in the cure of dry catarrh, on the ground of experience solely. The medicines prescribed by Laennec were the milder alkalis, either in the form of soap or the common carbonates. He assures us that he had repeatedly witnessed the most beneficial effects of those both in dyspnœa and asthma. They augmented the secretion from the bronchi, and lessened its tenacity. (De l'Auscult. Méd.) Our experience leads us to think favourably of this class of medicines. It will not be denied, at the present day, that their administration is grounded on sound pathological principles.

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[*] Zacutus Lusitanus seems entitled to the credit of first attempting the cure of diseases by restoring, by means of re-infection, cutaneous diseases that had been suppressed. See *Etmuller*, op. om. p. 193, who terms this a noble discovery, *egregium inventum*. This practice is particularly recommended in asthma by *Baglivi*: "Ex scabie retropulso si asthma fiat, cum scabiosa dormiendum est, ut scabies revocetur, vel urticis cædendum cutis." Op. p. 64. Even the last alternative is not very agreeable. The first we find practised at a comparatively recent period, and, it is said, with success. See Hautsierk's *Recueil*, &c.

[†] See his Dissertation, *Sull 'uso di Carbonato di Potassa per le renelli e peripneumonie.* Mem. Dell. Soc. Ital. tom. xii. 1804.

[‡] Elogio del. cel. Anat. P. Mascagni di T. Farnese. Milan, 1816.

Narcotics and Antispasmodics.—Remedies of this class have, as we have seen, been very generally employed in the paroxysm of asthma; they have likewise been often used in the intervals;—we cannot, however, say with much success. The majority of them, indeed, are much more calculated to do harm than good, by disturbing several important functions, and we refer to them here rather to warn the practitioner against their employment than to recommend this.

Electricity, galvanism, magnetism, animal magnetism, &c. have all been tried in asthma, and have all, it may fairly be said, failed. Successful results from each are, no doubt, recorded, but the general result is certainly complete failure. This, indeed, is to be expected on considering the pathology of the disease.

[Yet strikingly good effects are at times witnessed from the employment of galvanism. Several such are recorded by Dr. Wilson Philip (*Experimental Inquiries into the Laws of the Vital Functions*, Lond. 1807), and they have been witnessed by the writer in several cases; whilst in most instances the remedy has failed. Dr. Philip transmitted the galvanic influence from the nape of the neck to the pit of the stomach, and the power employed by him varied from ten to twenty-five pairs of plates. Since that time, galvanism has been repeatedly used in such cases, but of late, the plates employed by Mansford in epilepsy (*Researches into the Nature and Causes of Epilepsy*, Bath, 1829) have been more commonly, perhaps, employed in this country. The disease is unquestionably dependent upon erethism of the pneumogastric nerves; and all the phenomena exhibit that there is a spastic constriction of the small bronchia, from causes seated at the extremities or in the course of those nerves. The new impression, made by the galvanic agency, breaks in upon the concentration of nervous action, by exciting other portions of the nervous system, in the same manner as we observe spasms or ordinary cramps relieved, or paroxysmal diseases warded off by agents that are capable of suddenly impressing some part of the nervous system. (The writer's *Practice of Medicine*, 2d edit., i. 331: Philad. 1844.) The magnet has been used in similar cases, by establishing a magnetic current through the parts by means of several magnetised plates; and Laënnec affirms that he frequently found it diminish the oppression. (*New Remedies*, 4th edit., p. 415: Philad. 1843.)]

Inhalation of vapours and gases.—These, like narcotics, have most frequently been attempted in the paroxysm; still they have often been used during the intervals. They cannot be said to have been very beneficial. Some of them, however, seem to hold out a promise of being so even in the most common form of asthma; and, notwithstanding the slight benefit hitherto derived from them, we are disposed to look to this class of remedies with considerable hopes of success. Legitimate reasoning and strong analogy, at least, are in their favour; and it cannot now be denied that a good deal of direct experiment can also be brought to testify in behalf of some of them. The most common, if not the general cause of asthma, is, as we have seen, permanent alteration of the mucous membrane of the bronchi, frequently characterised by obvious signs and symptoms, sometimes only inferred from the morbid sensibility of the part to external influences. Although we know that similar affections of other parts are curable by general means, still we find that, when we are enabled to conjoin with these, applications that act directly upon the seat of the disease, the result is frequently much more speedy and certain. This is the case in diseases of the external skin, of the stomach and bowels, and in various local affections of the mucous outlets of the body. We are well aware that applications of this kind are frequently very injurious, in place of being beneficial; but this is an argument against their improper use only. Every one must have witnessed the extraordinary and instantaneous benefit afforded by local applications to the urethra, the throat, the eye, in cases which had been for weeks or months unrelieved by general treatment. In the dry catarrh we have a morbid state of membrane very analogous to some of the affections now alluded to; and although, as in these, the injudicious or improper use of local applications is likely to increase irritation in place of allaying it, it does not certainly seem unreasonable, *à priori*, to expect that due care in adapting the particular remedy to the individual case, might be followed by results equally happy. The history of asthma affords ample proof that the return of the paroxysms is very much influenced by the direct applications made accidentally to the bronchial membrane.

For a detailed account of the treatment of bronchial diseases by means of the inhalation of medicinal substances, we must again refer to the articles CATARRH and BRONCHITIS, and to the various publications which treat of this subject. We should only here remark that, of all the remedies which have been employed in this way, no one offers such a promise of advantage as the dilute chlorine gas. The observations and experiments detailed in the pamphlets of Gannal and Murray, and some trials which we ourselves have made of it, lead us to entertain very favourable expectations of benefit from it in bronchial diseases. The inhalation of vapours of various kinds, particularly of resins, has long been practised in pulmonary diseases. We can only refer to the subject in this place.*

[It has been proposed to immerse paper in a saturated solution of nitrate of potassa, and to dry it. A portion of this is set fire to, and allowed to burn in the vicinity of the patient, (*New York Med. Gaz.* and *Amer. Journ. of the Med. Sciences*, Jan. 1843, p. 262.) The writer has frequently observed good effects from it both in asthma and chronic bronchitis.]

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* See, Two Memoirs on the Inhalation of Chlorine, by *M. Gannal.* Translated by Potter. London, 1830. —Treatise on Pulmonary Consumption: by *John Murray*. London, 1830. On the Inhalation of Tar Vapour see the publications of *Sir A. Crichton*, and a paper by *Dr. James Forbes*, Med. and Phys. Journn. for Oct. 1822. [See also, on the inhalation of these substances, and on that of iodine, iodide of sulphur, &c., *E. J. Coxe*, Practical Treatise on Medical Inhalation, Philad. 1841; and *Dunglison's* New Remedies, edit. cit.]

Climate.—Asthma is one of the diseases in which the effect of change of climate or change of air is most conspicuous. It is the remark of every writer on the disease that certain patients have an increase or alleviation of their symptoms upon changing their residence from one place to another. Sometimes a very slight change, as to distance, has this effect; and even when little or no difference in the nature of the climate or locality can be discovered. According to our present experience these remarkable results can be explained on no general principle. One patient is best in the country, another in the city; one in an elevated situation, another in a low one. Floyer continued free from his asthma while at Oxford, but never failed to have an attack upon returning to his native air in Staffordshire. An asthmatic lady, mentioned by the same author, was always immediately attacked with dyspnœa upon going to Epsom from London, which went off on her return. Dr. Bree was invariably attacked upon visiting Warwickshire from his residence, forty miles distant, and only two hundred miles nearer the sea level. A gentleman, mentioned by Dr. Bree, could never sleep in the town of Kilkenny, in Ireland, without being attacked with asthma; and Lord Ormond could never sleep *out* of the same place without suffering in the same way. The sister of an asthmatic patient of ours, who had long suffered from this disease in Sussex, was completely cured by going to reside in London, and remained well for a period of ten years which intervened between her removal and death.

[As a general rule, perhaps, the air of the crowded city is more congenial than that of rural and elevated situations. A college acquaintance of Dr. Watson can sleep in one inn in Cambridge, and not in another; and he assured Dr. Watson, that when in Paris, he never escapes an attack of asthma, if he attempts to sleep in the back part of Meurice's hotel, and yet never suffers if he sleeps in a front room. (Watson's *Lectures on the Principles and Practice of Physic*, Amer. edit., p. 643, Philad. 1844.) An asthmatic friend of the writer, one of the most respectable inhabitants of Baltimore, is unable to sleep at his country-house, which is not more than a mile and a half from the centre of the town. He has tried the experiment frequently, and the result has always been the same. (*Practice of Medicine*, 2d edit. p. 328.)]

No doubt these remarkable effects depend on causes of an analogous kind; and there seems no reason to doubt that the general principle will yet be discovered, which will reconcile and explain all the seeming contradictions and anomalies. At present our knowledge falls very far short of this precision; still, attention to the ascertained influence of particular climates on particular diseases, and on the system in general, and a close study of the pathology of the individual cases of asthma, will enable us frequently to be of much service to such of our patients as have it in their power to make choice of their residence.

In selecting a climate for an asthmatic patient, we must be guided precisely by the principles which direct the application of any other remedy or course of treatment. A minute examination of the individual case is always essential; and in making this with a view to the application of climate, we must endeavour to ascertain, 1st. the state of the bronchi; 2d. the state of the general health, or the diseases with which the asthma may be complicated; 3d. the relation, as to cause and effect, which these diseases bear to the asthma; 4th. the character of the patient's general constitution or temperament; and lastly, the ascertained effect of particular climates, localities, and seasons, upon his individual case.

Although asthma is a disease of every climate, and although many patients have their severest attacks in summer, there can be no doubt, that, in the great majority of cases, a mild and equable climate is much more favourable to the asthmatic than one that is cold and variable. Such a climate proves beneficial in various ways, more especially in the cases dependent on any form of chronic catarrh. It tends directly to remove the very basis of the disease—1st. by the direct application to the part of air of a milder and more agreeable temperature; 2d. by rendering the attacks of acute catarrh less frequent, and thereby affording longer intervals for the restoration of the irritated membrane; 3d. by promoting the cure of the accompanying disorders, which frequently exert a most unfavourable influence, both on the structural alteration of the membrane, and on the spasmodic affection of the bronchial muscles; and more particularly the disorders of the digestive organs and the skin; 4th. by enabling the patient to improve the general health and strength, and to fortify the system against the impression of cold by constant exercise in the open air, and by the uninterrupted use of the cold bath throughout the year. For more particular information on this part of our subject, we must refer to the articles CHANGE OF AIR and CLIMATE in the present work, and to the very valuable work of Dr. [Sir James] Clark on the general influence of climate on chronic diseases.*

Mineral waters.—These remedies have been much employed in asthma, particularly on the continent. We shall borrow from the author just quoted the few remarks which we intend to offer on this part of our subject. "When asthma is complicated with chronic irritation of the bronchial membrane, or of the digestive organs, or with a congested state of the hepatic system, or an unhealthy skin, a course of warm mineral water will prove of much benefit, by relieving those morbid affections which often induce and always aggravate asthma. There are several mineral waters on the continent which have a high reputation, and we believe deservedly, in this class of diseases. Of this kind the springs of Ems on the Rhine, of Bonnes and Cauterets among the Pyrenees, and of Mont D'or in Auvergne, are held in the greatest estimation. But there is more difficulty in selecting a mineral water for the asthmatic patient than for any other;

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* The Influence of Climate. Second Edit. Lond. 1830. [Third edit. under the title of the Sanative Influence of Climate, Lond. 1841]

as the source, most suitable to the diseases which complicate it, may be in a situation which decidedly disagrees with the asthma. However well suited the waters of the Pyrenees or of Mont D'or might be to the bronchial disease, it would be useless to propose a residence at either of those places to an asthmatic person who could not breathe at a great elevation; or to send him to Ems or Carlsbad who could not live in a valley; although the waters of these places might be admirably adapted to the bronchial or abdominal diseases with which the asthma is complicated."

The mineral waters of England, of an analogous character, may be used in the same cases; and where abdominal plethora exists, the aperient waters of Cheltenham or Leamington will be beneficial in relieving this. The waters of Bath have also been found beneficial in some cases; but in general they are not well suited to the pulmonary affection, however they may be so to some of the complicating diseases.

Diet.—The diet in all chronic diseases is a matter of great practical importance. It is of more especial importance in asthma, because disorder of the stomach is so frequent a concomitant and even a cause of the disease. All the good writers on asthma are strong advocates for moderation in diet; and there is no disease in which patients are more unanimous on the same point. Floyer is particularly zealous against excess both in eating and drinking. "Hunger and thirst (he says) are the best cure for the asthma, especially little and very small drink." "The less the asthmatics are nourished, (he says, in another place,) the longer are the intervals of the fits, and the clearer is their breath." The principles which ought to regulate the diet are few and simple; but the practice must be modified by the circumstances of individual cases. Temperance and moderation are universally applicable and necessary, as is also habitual vigilance against being seduced from the regularity of invalid habits. The particular system of diet is indicated much more by the concomitant affections than by the asthma itself. If the disease is unattended by any very decided disorder of structure in the bronchi, or elsewhere, the diet may be more generous and less strict than under a different state of things. If there is marked affection of the bronchi, with little disorder of other parts, the only circumstance of much importance to be attended to respecting diet, is that it does not tend, by being overfull, directly to increase this bronchial affection, and to induce other disorders which might aggravate the primary disease. But in almost all cases of asthma, we have already other disorders which tend powerfully to aggravate and keep up the bronchial affection, and in the alleviation or cure of which diet is of paramount importance. In this list we may include dyspepsia with its numerous progeny of general and local diseases, plethora, gout, gravel, diseases of the mucous membranes generally, of the liver, brain, uterus, skin, &c. &c. For the dietetic management of these diseases we must refer to the articles which treat of them respectively, and to the general article Diet. The co-existence of the asthmatic paroxysm scarcely, in any degree, alters the diet proper in these affections. JOHN FORBES.

ASTRINGENTS, (from *astringere*, to contract,) are substances which produce contraction and condensation of the muscular fibre. It is still undetermined whether these effects are the result of the action of the astringent on the muscular fibre itself, or on the nerves of motion in contact with it. Muscular fibre is a compound substance possessing compound functions, some of which, as for instance its cohesiveness, flexibility, and extensibility, are physical; others, as its sensibility and contractility, vital properties. We may assume it as a fact, that the tenuity or density of a muscle, not under the immediate influence of volition, is solely dependent on vitality. It is this vital tenuity which enables a muscle, during life, to sustain a weight that would instantly overcome its cohesive power and tear it asunder, after death.

Most writers on the Materia Medica have endeavoured to explain the influence of astringents on the living body by reasoning analogically from their action on dead animal matter. It is true that substances which give toughness, solidity, and impermeability to the soft skin of a dead animal, so as to convert it into leather, operate as astringents on the living muscular fibre. Looking at this fact, were the inquiry to proceed no farther, it would not be surprising that erroneous inferences should be induced from it: indeed, the presence of life seems, in some instances, rather to favour than to resist the operation of astringents.

If we refer the action of astringents to the laws of the living system, it is evident that they can only act as stimulants; but, in admitting this, it is requisite to draw the distinction between astringents, stimulants, and tonics. Stimulants act powerfully on the excitability of the part to which they are applied, producing sensation and sudden contraction or motion, and extending their action over the whole frame; but this is followed by corresponding relaxation. Astringents operate, also, by causing sudden contraction; which is different, not only in degree but in kind, from that produced by general stimulants. Tonics, while they promote contraction and density, differ from astringents, in so far that their action is slowly produced, and confined within that limit which may be regarded as the natural state of the healthy solid. Thus the distinction between the three powers, stimulus, tone, and astringency, is sufficiently obvious.

If an astringent be applied to any part of the body on which the action induced admits of ocular demonstration, the first effect produced is contraction of the muscular fibres and blood-vessels of the part. It is in consequence of the contraction which astringents produce in the fibres of living tissues, that when applied to a wound or bleeding surface, the hemorrhage is arrested. If an astringent be applied to the lips, they become pale, from the diminished diameter of the blood-vessels, and the increased opacity of their coats; while a dryness and roughness is felt on the palate, the result of corrugation of the parts. In this case, as far as regards the corrugation, the nerves of motion only are impressed, and a movement in the muscular fibres which they supply follows the impression. If this view of the subject be correct, we may venture to explain the operation of astringents, by saying that they stimulate *directly* the *ultimate fibrils* of the *motor* nerves, and through them produce an immediate effect upon the insensible contractility of the muscular fibres which these nerves supply. It is not difficult to conceive that such an action may be propagated by sympathy to other parts, or even to the whole system. Hence, if any acerb fruit, as a sloe, for instance, be chewed, a peculiar feeling, along with the corrugation, extending over the whole body, is induced.

As it is not within the scope of this work to examine the characters of particular astringents, we shall merely class them according to their influence and mode of action. All astringents may be classed under three distinct heads:—1. those exerting a tonic influence; 2. those exerting a sedative influence; 3. those operating chemically.

1. The substances embraced under the first head are both organic and inorganic: the astringency of the former chiefly depends on tannin [tannic acid, the *principium scytodephicum* or *Gerbestoff* of the Germans,] in combination with gallic acid, and with hæmatin, a peculiar principle lately discovered: that of the latter on oxygen in various states of combination. *Tannin* may be separated from the other components with which it is combined in vegetable bodies; and in this state it has been employed on the continent in cases of uterine hemorrhages; and, according to M. Cavalier, has succeeded in staying these when ordinary astringents have failed. [It has, also, been given in diabetes, leucorrhœa, gonorrhœa and the most obstinate chronic catarrhs; in hæmoptysis, in the sweats of phthisis, &c. &c. (The writer's *New Remedies*, 4th edit. p. 37: Philad. 1843.)] It may be procured sufficiently pure for medicinal use, by evaporating a solution of catechu in cold distilled water, filtering and evaporating to dryness in a water bath. The dose of tannin is four grains, repeated every two hours.

Gallic acid is also administered in nearly a pure state in *Ruspini's styptic*, which the writer of this article has discovered to be little more than a solution of gallic acid in alcohol diluted with rose-water. A simple solution of gallic acid is equally effective; and in this manner it may be administered in doses of from five to twelve grains, repeated every hour, in hemorrhages of the intestinal canal, or in those of the bladder of urine, or of the prostate gland. But the usual mode in which tannin and gallic acid are exhibited is in their natural combination, with other vegetable components, as found in the roots of rhatany (krameria *triandria*); bistort (polygonum *bistorta*); the common dock (rumex *obtusifolius*); avens (geum *urbanum*); and tormentil (tormentilla *erecta*); in the bark of the oak (quercus pedunculata); that of the larch (pinus *larix*); and of the white willow (salix *alba*); in the leaves of bears' wortleberry (arbutus *ursi*); in gall-nuts, the excrescences formed on the leaf-stalks of the quercus infectoria by the puncture of the cynips quercifolii, and the deposition of its eggs in the wound; in the petals of the rose (rosa *gallica*); balaustines, the flowers of the pomegranate, (punica *granatum*); and in the shell of the fruit of the same plant. Tannin and gallic acid are also found in natural combination in kino, the inspissated juice of the nauclea *gambir*, and of several species of eucalyptus; and in catechu, the prepared juice of the acacia *catechu*. In prescribing any of these varieties of combination of tannin and gallic acid, it is of importance to be aware that the union of many substances with them may either destroy their astringency, or render inert the substance combined with them, so as to defeat altogether the intention of the practitioner. Thus all infusions or decoctions of astringent vegetables are rendered nearly inert by combination with infusions or tinctures of cinchona bark, cusparia bark, and calumba root: they destroy the active principle of ipecacuanha; as well as the astringent influence of the salts of lead, copper, zinc, iron, and antimony, and some of those of mercury. The oxymuriate or chloride of mercury, however, is not precipitated by them; and, it is also a curious fact, that although tartar emetic is copiously precipitated and rendered inert by infusion of galls and most other solutions of astringent vegetable matter, decoction of oak bark causes no change on that salt. The reason of this is not understood. The mineral acids weaken the activity of astringent vegetable solutions; the astringency of kino is completely destroyed by combination with an alkali; and the astringent tinctures are rendered inert, consequently useless, when combined with the cretaceous mixture. The natural combination of tannin with hæmatin, occurs in logwood, the wood of the hæmatoxylon *campechianum*. It is uncertain whether the hæmatin, which appears to be one of the colouring principles of the logwood, increases the astringency of tannin in the same manner as the gallic acid. Nearly the same substances which are incompatible with vegetable infusions and decoctions containing tannin and gallic acid, however, are also incompatible with the decoction of logwood, or the solution of its extract.

The inorganic astringents exerting a tonic influence are substances containing oxygen united to various bases. Of those in which it is combined with a simple radical, the most useful are the sulphuric and acetic acids. The action of these as astringents is not easily comprehended without referring to their operation as local stimulants, exerting their influence on the circular fibres of the blood-vessels: at all events there is no foundation for the opinion entertained by Boerhaave and others that these acids, in a diluted state, coagulate the fluids when taken into the system. In administering sulphuric acid, it should be recollected that its action is much modified by dilution, and thence that it may be prescribed in both active and passive hemorrhages; that it should be cautiously prescribed to women who are suckling, as it often proves hurtful to the infant; that, in combining it with opium, the activity of the narcotic is much increased by the formation of the sulphate of morphia; and that it ought not to be combined either with kino or catechu. The same directions are applicable to the administration of diluted acetic acid. Under this head of astringents we also find the metallic salts. The styptic nature of many of them has been long known. Among the salts of iron, the sulphate can only be employed internally in passive hemorrhages, such, for example, as take place in scurvy and purpura: the hydrochlorate, in the form of the muriated tincture, diluted, is chiefly employed as a local astringent. The sulphate of copper, in doses of from one-sixth of a grain to half a grain, combined with opium, has proved useful in chronic diarrhœa; but notwithstanding the beneficial effects derived from it in such cases, it must be acknowledged that the internal administration of sulphate of copper is always hazardous. If headach, vomiting, gripings, and cramps in the limbs supervene on its use, it should be instantly discontinued, and a solution of white of eggs, with sugar, should be freely administered; or from ten to fifteen grains of ferro-cyanate of potassa in water. Except as external astringents, the salts of zinc are rarely employed. Nitrate of silver, also, except as a local application, in gargles and lotions, and in the form of lunar caustic, is in limited use as an astringent. In ulceration of the cornea, and in obstinate inflammation of the conjunctiva, two grains of the nitrate in a fluid ounce of *distilled* water is of sufficient strength as a local application; but when the ulcers are of a nature to threaten collapse of the eye, and protrusion of the iris, the proportion of the nitrate should be at least ten grains to a fluid ounce of distilled water; and the same degree of strength is requisite when granulations show themselves. The solution, taken up on the point of a hair pencil, should be first dropped into the eye at one angle, and then followed by a drop of almond oil, applied in the same manner.

2. The substances producing the effect of astringents by exerting a sedative influence on the system, are chiefly the salts of *lead*. The acetate, which is that most commonly employed as an internal medicine, is a valuable sedative astringent; and when combined with opium, and taken in conjunction with distilled vinegar, to prevent it from being converted into the carbonate, it may be administered with perfect safety. Indeed we have satisfied ourselves that the carbonate is the only poisonous salt of lead; and that the others become so in the direct ratio of their aptitude to be converted into the carbonate; thus we find that the subacetate is more poisonous than the acetate. From this fact, it might be concluded that the carbonate of lead is the best sedative astringent; but as it accumulates in the system, and its action is not so easily regulated as the acetate, the latter is generally preferred for internal use. We have given the acetate in conjunction with distilled vinegar, in doses of from six to ten grains every fourth hour, for six and eight successive days with the most decided benefit, in pulmonary hemorrhages, and those of the intestinal canal. The vinegar evidently prevents the decomposition of the acetate by the carbonic acid extricated in the intestinal canal; and on account of its aptitude to change into the carbonate, the alkaline carbonates ought not to be given at the same time, although these are recommended, on the authority of Dr. Christison, as antidotes in cases of poisoning by acetate of lead. It may be administered in the form of pills, and washed down with a draught containing half a fluid ounce of distilled vinegar, and twelve minims of tincture of opium. When its effects are required to be suddenly produced, solution is a preferable form of the medicine. Nothing is more absurd than the custom of prescribing infusion of roses acidulated with diluted sulphuric acid, at the same time with pills containing the acetate of lead: the acetate is decomposed, and an insoluble, consequently inert, compound is produced; so that the remedial influence of both the salt of lead and the sulphuric acid is destroyed. The subacetate and the carbonate of lead are seldom employed except as external applications. It has been asserted that the effects of poisoning have followed even their external application; but in the only well authenticated case, that related by Dr. Wall, in the first volume of the Transactions of the College of Physicians, the colic which was induced followed the immersion of the legs twice a day, for ten days, in a bath of the solution of acetate of lead. We have never seen any bad effects result from the external use of either the acetate or subacetate, but, assuredly, the carbonate should be used with caution to external sores; and neither the subacetate nor carbonate should be internally administered. If symptoms of poisoning display themselevs during the use of the salts of lead, the best antidotes are sulphate of magnesia, or sulphate of soda, combined with opium; and if paralysis has already supervened, the acetate of strychnia will be found more useful than any other remedial agent.

The only other sedative astringent necessary to be noticed is *cold*. The first effect of a sudden abstraction of heat from the body, or any part of it, is a peculiar sensation, which is accompanied with paleness and a corrugation of the skin; resembling the effect produced by it on dead matter. In the living body, however, its effects are not confined to where it is applied, but propagated to internal and distant parts; consequently the entire system experiences the influence of cold when it is applied to a part. So far the effect of cold is truly astringent; but if the application of it be short or transitory, a reaction in the system takes place, and defeats its former beneficial influence; therefore, to render cold a useful astringent in hemorrhagic attacks, it must be applied for some length of time, in which case it checks the flow of blood rather by its sedative than its astringent influence. In employing cold, something may be gained by using some media instead of others: thus cold humid air abstracts heat from the body more quickly than cold dry air, in the ratio of 330 to 80; and, if water be employed, the more free the fluid is from foreign ingredients, the more rapidly the temperature of the body is lowered. The method of employing cold is also sufficiently important to require attention: in hæmoptysis, the body should be exposed to cold air, and ice internally administered, whilst the lower extremities are kept warm: in hæmatemesis, the same exposure is proper, but instead of ice taken by the mouth, iced water should be injected per anum; and in uterine hemorrhages nothing is so effectual as the injection of cold water into the uterus by means of the stomach-pump, so as to keep a constant stream of the fluid applied to open vessels. A temperature of 32° is sufficient for every purpose indicating the use of cold as an astringent.

With respect to substances which produce the effects of astringents by acting chemically on the contents of the stomach and intestines, very few remarks will suffice. Both lime and its carbonate, or chalk, operate in checking diarrhœa by neutralizing the acescent matters which augment the irritability of the intestines, and keep up their morbidly increased peristaltic movement. Owing to the little solubility of pure lime, chalk, rubbed up with mucilage of gum so as to suspend it in any fluid, is preferred in cases of diarrhœa. It is incompatible with vegetable infusion containing much tannin, and with preparations of ipecacuanha. When it is necessary to continue the use of the chalk mixture for some time, the bowels should be cleared with a purgative, as accumulations in the form of hard balls are apt to take place in them, and, lodging in the folds of the intestines, to cause much inconvenience and, occasionally, hazard.

[The agents, considered thus far, may be regarded as direct astringents; but profuse evacuations may be connected with different states of the living system, so that agents, possessed of no astringent properties, may check them or produce an astringent operation indirectly. Hence, there may be *direct* and *indirect* astringents, as there are direct and indirect tonics. Opium, for example, by allaying the augmented peristole in diarrhœa, may exert an action of astringency, and diminish the number of discharges: accordingly, it is often had recourse to in such cases. Again, the increased discharges of dysentery are induced by an inflammatory condition of the mucous coat of the intestines: bleeding, therefore, by allaying this inflammation, and castor-oil,—given occasionally, so as to remove gently the morbid secretions, —by taking away the cause, may check the effects. A predominance of acidity in early infancy lays the foundation for many of the bowel complaints, which are so common at that age, and keeps them up when once established. A proper antacid, as before observed, by neutralizing the acid, takes away the cause, and thus becomes an indirect astringent. (The writer's *General Therapeutics and Mat. Med.* ii. 96, Philad. 1843.)]

In a therapeutical and practical point of view, astringents, when administered on proper principles, are a valuable class of remedies. In intermittent fevers, the vegetable astringents have been successfully employed in the same manner as simple tonics. We can form no other idea of the manner in which they prove beneficial than by supposing, that they obviate the relaxation which favours the influence of the exciting causes of agues. On this account it has been asserted that tonics and astringents operate in every respect in a similar manner; but many tonics, such, for instance, as sulphate of quinia, possess no astringency, and nevertheless are useful in intermittents; and it must be admitted that, as pure astringents are seldom or never given alone in intermittents, it is difficult to ascertain how much of the benefit is due to their influence. They are employed in continued fevers only to moderate incidental diarrhœa and internal hemorrhages.

In the phlegmasiæ, astringents are contra-indicated as general remedies; but in that state of inflammatory action which assumes a chronic character, and is kept up by debility and increased nervous excitability, such as occurs in the eye and in the tonsils, they are local remedies of considerable value. Solutions of the metallic salts, and infusions of astringent vegetables, with the addition of diluted sulphuric acid, are well adapted for these cases. Indeed, after inflammatory action has been subdued by the use of the lancet and other antiphlogistic measures, the application of cold and astringent solutions tends greatly to restore the healthy action of the part.

[In diphtheritic affections of the throat, a solution of nitrate of silver has been found of great benefit; and in cases of diphtheritic laryngitis, the inhalation of finely powdered alum has been markedly advantageous. Not only—according to Laennec—has it afforded great and speedy relief in tracheitis, but in laryngitis isthmitis, and pharyngitis.]

No remedies are so important in the hemorrhagiæ as astringents; but they are not to be indiscriminately prescribed, or at all times employed: it is, therefore, necessary, to inquire what are the circumstances indicating their use in these cases? Hemorrhages are properly divided into active and passive. In the first or active kind, the flow of blood generally arises from a plethoric condition of the vascular system; and it may, in some respects, be regarded as an effort of nature to relieve the morbid fulness of the vessels. In this form of hemorrhage, tonic astringents are improper; and even those exerting a sedative influence should not be resorted to until the vessels be either emptied spontaneously or by the use of the lancet. In passive hemorrhages the animal fibre is relaxed, the red particles of the blood are diminished, and diffused in a superabundance of serum, so that the blood assumes a pale watery aspect; while the system suffers from general debility. In this state, astringents are decidedly indicated, and may be liberally employed. Although these opposite states appear very obvious in description, yet much judgment and attentive observation are requisite to distinguish them on many occasions. If we take, for example, epistaxis, let us enquire, what are the peculiar symptoms which clearly indicate the employment of astringents? When bleeding takes place from the nostrils of young persons of a plethoric habit, it may be critical, or connected with congestions, or a determination of blood to the head. In this state the hemorrhage should not be checked by astringents, unless it is so profuse and long continued as greatly to lower the pulse, to produce pallor of the countenance, and exhaust the general strength. On the contrary, when epistaxis happens in weak boys or youths, or in old persons; or when it is symptomatic of diseased liver, or some other internal organ; then astringents may be at once administered to check the direct loss of blood, whilst other means are resorted to for removing the exciting causes of the hemorrhage. The best astringents in these cases are solutions of metallic salts and of alum: they may be either injected into the nostrils, or dossils of lint soaked in an astringent solution may be inserted; while at the same time cold water is applied to the face and nape of the neck.

In hæmoptysis, if the excitement be considerable, the lancet must be employed, after which the application of cool air, cold water, or ice to the chest, with the internal administration of acetate of lead and diluted acetic acid, comprehends the necessary measures. When the loss of blood is considerable, these active measures should be immediately resorted to; but if it do not assume an alarming aspect, and no predisposition to phthisis exists, and especially if it is connected with suppressed menstruation, measures calculated to moderate the hemorrhage should be resorted to. The acetate of lead is admirably adapted for such cases, and may be given to the extent of half a drachm in twenty-four hours, if vinegar be administered in conjunction with it.

In hæmatemesis, the gallic acid or Ruspini's tincture may be administered, with iced water; but in treating cases of vomiting of blood, we should always bear in remembrance the fact, that this form of hemorrhage is seldom idiopathic, and consequently that the propriety of administering astringents must depend on the nature of the primary disease. The exhaustion which occurs in hæmatemesis also demands some caution in prescribing sedative astringents; and it is occasionally even necessary to combine cordials with them. In hæmorrhois, the propriety of employing astringents is determined altogether by the nature of the remote causes of the disease. The most common is costiveness, laxatives are therefore indicated; but after this state is removed, when the tumours are large, and the bleeding considerable, astringents should be employed. A pint of iced water thrown into the rectum every morning, and an ointment composed of powdered galls, or of kino or catechu, or oxide of zinc may be used. Accompanying hæmorrhois, we not unfrequently meet with prolapsus ani: the return of the gut is easily effected, but it is only by bracing the relaxed sphincter that we can retain the gut in its place, which is best accomplished by injections of the infusion of balaustines or of the pomegranate bark.

Hæmaturia is generally owing to some disease of the bladder or prostate gland; but, without neglecting the primary disease, much advantage is derived from the internal administration of a solution of gallic acid in infusion of uva ursi. The acid passes the kidneys unaltered, and is directly applied to the bleeding vessels.

In menorrhagia, where there is general debility, astringents are most beneficial; in which case cold water injected into the uterus should hold either gallic acid or alum in solution. If the former be employed, half a drachm may be used for every pint of water; if the latter, a drachm will be sufficient.

[Dr. Stevenson (*Edinb. Med. and Surg. Journal*, July 1843, p. 103—110,) has published several cases to show the value of gallic acid in uterine hemorrhage and hæmaturia. When its administration by the mouth is impracticable or objectionable, it may be used in the way of enema.]

In all external hemorrhages, where it is unnecessary to take up vessels, cold water is the best astringent: it should be continued until a clot is formed, after which the use of every application should be suspended, rest enjoined, and nature left undisturbed to perform her curative process.

In the profluviæ, the employment of astringents is often injurious: in dysentery, in particular, it requires much caution. If astringents be indiscriminately prescribed, they may increase an inflammatory state of the mucous membrane, with all its consequences; and they seldom fail to cause most distressing meteorismus. When the diarrhœa, however, is considerable towards the termination of the disease, and threatens dangerous debility; and if the powers of the stomach are at the same time much weakened, mild astringents may be advantageously administered.

In simple diarrhœa, depending on loss of tone, whether arising from debility of the whole system, or causes acting on the intestines alone, astringents may be administered with great freedom. The best for this purpose are those containing tannin and gallic acid, especially the krameria and tormentil, combined with aromatics; for example, the essential oils of cinnamon or of cassia in the state of oleo-saccharum.

In diabetes, astringents have been much employed: they have occasionally proved useful; but they are not to be relied upon in this intractable disease. They have been found beneficial in ephidrosis; but this must greatly depend on the nature of the primary disease, to which the inordinate action of the cutaneous exhalents is to be traced.

In gonorrhœa virulenta, much diversity of opinion prevails with regard to the employment of astringents. In the incipient stage of the disease, when there is a slight turgescence only of the lips of the urethra, with heat, but as yet no discharge, the employment of an astringent injection, sufficiently stimulating to excite slight pain in the urethra, will often wholly check the disease; and the same benefit occurs when, with scarcely any pain or scalding, the disease displays itself merely by the discharge. The best astringents for this purpose are the metallic salts, such as sulphate of zinc, in the proportion of two grains to a fluid ounce of water; or sulphate of copper, in the proportion of one grain to the same quantity of water. When the pain and scalding, in a more advanced stage of the disease, are very severe, the best injection is subcarbonate of lead, rubbed up with mucilage and opium. When, however, the ardor urinæ is attended with frequent chordee, and pains in the loins and thighs, with much general excitement, astringents prove hurtful. The use of astringent injections, in any stage of gonorrhœa, is nevertheless objected to by some practitioners, who conceive that they tend to induce stricture, and other diseased states of the urinary canal,—an opinion unsupported by correct observation; on the contrary, it is the long uncontrolled inflammatory action which is productive of such states of the urethra.

In leucorrhœa, astringent injections have been freely and advantageously employed; when due care has been taken to discriminate between mere laxity, favouring an increase of the natural discharge from the vagina, from deficient action in the absorbents, and that state of excitement in which the discharge is augmented in quantity, and greatly altered in quality. In the first state, much benefit is derived from the local use of nitrate of silver, in the proportion of two grains of the salt to one fluid ounce of water; and five minims of diluted nitric acid: the latter is necessary to protect the nitrate from immediate decomposition by the albumen contained in the diseased secretion of the vagina: the other metallic salts, particularly sulphate of zinc and of copper, solution of alum, and decoction of galls and other vegetable astringents, have been, also, found serviceable. In the second state, it is useful to apply leeches over the pubes or on the groins; or a cupping-glass on the sacrum; with the use of the hip-bath, before employing injections: and even when the proper period to resort to them arrives, it is of importance to select those that operate by exerting a sedative as well as astringent influence.

In affections connected with calculi in the urinary organs, astringents have been employed with evident benefit. This is, perhaps, owing to their improving the tone of the digestive organs, and consequently effecting a more complete conversion of the food into healthy chyle.

In gastric irritation, the acid which is formed in the stomach favours greatly the deposition of uric acid in the kidneys; whatever, therefore, tends to improve the tone of the stomach must necessarily lessen the predisposition to the formation of calculi: in this manner astringents operate in relieving calculous diseases.

In many local affections, the application of astringents is useful. In many superficial inflammations, as, for instance, erysipelas, erythema, and herpes, which are more or less attendant on febrile states of the constitution; as well as in ophthalmia, aphthæ, and similar affections, the local employment of astringents forms an important addition to the general treatment.

A. T. Thomson.

ATROPHY, from *α* privative, and τροφὴ, *nutritio*, is a term used in medical language to signify a deficiency in the nutritive powers of a part, in consequence of which its natural dimensions are reduced, and the number of its constituent molecules diminished. The process of nutrition essentially consists in the several solids receiving from the blood, as it circulates through them, a succession of particles similar to those of which their structure is already composed; and throwing off into the same circulating fluid such other particles as are destined to be removed from their texture. The process by which certain particles are separated from the blood, and appropriated to the structure of the solids, is termed assimilation; and the process of detaching such particles as are no longer fitted to form an integral part of their structure, may be termed the process of dis-assimilation, or of interstitial absorption.

On the equilibrium of these two processes the due nutrition of the solids essentially depends; if either process preponderates, the balance of nutrition is destroyed: if, for example, the powers of assimilation exceed those of dis-assimilation, the nutrition of the part becomes excessive; but if, on the contrary, the powers of dis-assimilation preponderate, the nutrition of the parts is diminished in proportion. When one or more tissues or organs are affected in the last mentioned way, they are said to be in a state of atrophy; but when the affection is general, and the whole system participates in the atrophy, the term marasmus, or emaciation, is more usually employed to express it. For this reason we shall confine the following observations to cases of partial or local atrophy.

The effects of atrophy vary considerably, according to the extent of the affection, and the texture of the part affected. The atrophy, for instance, may be confined to one of the component tissues of an organ, the others still retaining their natural dimensions, or even acquiring an increased development; as in the peculiar alteration of the liver, described by Laennec as a new morbid production, under the name of *cirrhosis;* but which Andral has shown (Clinique Médicale, t. iv. p. 7.) to depend upon atrophy of the red, and hypertrophy of the white, substance of that viscus. In this form of atrophy the organ affected may retain its natural dimensions, or may even increase in size, the atrophy of one of its tissues being more than compensated for by the hypertrophy of another. When the atrophy affects all the elementary tissues of the part, a proportionate loss of substance is necessarily produced. The membranous organs are rendered thinner, and this thinning of their tissue may even go on until it ends in their perforation. The parenchymatous organs are diminished in bulk, except in those cases where their internal structure becomes rarefied, as occurs in atrophy of the bones and lungs. We have seen the femur of an adult so atrophied internally as to float on the surface of water like so much cork, while externally it presented no appearance of any such alteration. The colour of an atrophied organ is usually paler than natural; it receives less blood, and is often so altered in its appearance as to retain few traces of its orginal organization; being in some instances almost wholly reduced to cellular tissue. In cases of extreme atrophy, the organ affected may be reduced to a mere rudiment, or may even disappear altogether. It is a curious fact that several organs, as they fall into a state of atrophy, frequently have a preternatural quantity of fat deposited on their surface; and this deposition of fat is in general proportionable to the extent of atrophy, and consequent diminution in the size of the organ. We have repeatedly seen the muscular parietes of the heart, especially those of the right ventricle, considerably reduced in thickness, and coated with a deep layer of fat: near the apex of the ventricle, this atrophy of the muscular, and hypertrophy of the adipose tissue is particularly remarkable; the muscle being sometimes as thin as paper, and covered with a layer of fat nearly half an inch in depth. "Analogous phenomena are observed in certain circumstances in the animal kingdom; where, in proportion as an organ decreases in volume, a fatty secretion is found to be deposited around it: thus in the spermaceti whale, and many of the fish tribe, an oily substance fills the very considerable space which exists between their diminutive brain and the parietes of the cranium."* There are some cases in which the atrophy of an organ may be regarded as a healthy or physiological process; as when parts, whose functions are no longer required in the economy, waste away or even disappear altogether. In the fœtus in utero the functions of the vesicula umbilicalis cease after the third month, and the organ itself disappears soon after; the membrana pupillaris likewise ceases to exist before the full period of fœtal life is accomplished. Other organs that seem to be essential in fœtal life fall into a state of atrophy soon after birth; amongst such may be enumerated the ductus arteriosus, and venosus, and other blood-vessels used only in the fœtal circulation; the suprarenal capsules, the left lobe of the liver, and the thymus gland. Again, certain organs that are constantly employed in youth and manhood cease to be as actively employed in advanced life, and accordingly fall into a state of atrophy. The thyroid gland decreases in old age; the organs of generation, too, lose their natural size. M. Ribes has particularly described the alterations which the corpus cavernosum penis undergoes in old age: "the cells become larger, and the membranous septa that intersect its interior become thinner, and are even partially absorbed, so that quicksilver injections pass readily into it." (Bull de la Faculté, t. vi. p. 299.)

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* Pathological Anatomy, translated from the French of Professor *Andral* by Dr. Townsend and Dr. West.

The ovaries and mammary glands are also, in advanced life, reduced to mere rudiments; and in extreme old age every organ in the body falls into a state of atrophy; the digestive apparatus being the last to share in the general decay. Andral states that atrophy, and consequent rarefaction of the parenchyma of the lung, is one of the most constant causes of the emphysematous condition of that organ so frequently observed in old age. "In the parts where this alteration exists, there are no longer to be found either bronchial ramifications or vesicles properly so called, but merely cells of greater or less diameter, divided into compartments by imperfect septa or irregular laminæ. The portion of lung in this condition bears a perfect resemblance to the lung of the tortoise tribe." (Op. cit.) We have had repeated opportunities of verifying the accuracy of this description of the changes which the texture of the lung undergoes in advanced life. Tenon calculates that the osseous parietes of the skull lose one-fifth of their weight in old age. (Mém. de l'Institute, t. i. p. 221, an. vi.) M. Desmoulins found the brain in persons above seventy specifically lighter than at forty years of age; and its actual weight, he states, is diminished from one-fifteenth to one-twentieth of the whole: he likewise states, that in old persons of both sexes the trunks of the nerves, and their filaments, are considerably diminished in size below their standard in the adult.*

These phenomena of atrophy are still more remarkable in those animals which, during the progress of their lives, undergo certain metamorphoses. Thus in the tadpole, when about to change into a frog, the tail gradually disappears, and the gills are obliterated, their place being supplied by lungs, which were in a rudimentary state so long as the animal retained the form of a tadpole and respired only in water. (*Andral*, Op. cit.)

In all these instances the atrophy may be regarded as a natural phenomenon, regulated by a general law in physiology—that all organs attain their maximum of development at that period when their functions are most exercised, and subsequently decline as their functions cease to be required in the economy.

But we likewise find atrophy occurring under other circumstances, and constituting a true morbid alteration. Amongst the pathological causes of atrophy may be enumerated:—

(*a.*) An original deficiency of development. From the science of embryology, which has been so successfully cultivated of late years, we learn that the formative process may be arrested at any period during the evolution of the fœtus, so as to cause a total suspension in the development of any organ or set of organs; in consequence of which the organ thus arrested in its development continues, up to the period of birth, either imperfectly formed or altogether deficient; in fact, remains precisely as it was at the period when its evolution was suspended. In this way are produced the different varieties of *congenital atrophy*. In cases of congenital atrophy of the limbs, Rostan and other pathologists have seen the hemisphere of the brain on the side opposite the deformity converted into a serous sac, as if from having been early arrested in its development; and M. Serres states that when the cervical swelling of the spinal cord is deficient, the upper extremities are likewise deficient; and that when the lumbar swelling does not exist, the lower extremities are invariably wanting. These observations would lead us to conclude that there subsists an intimate relation between the perfect development of certain organs and the perfect evolution of the nervous centres; but, on the other hand, there are also facts which would lead us to infer that this relation is much less absolute than was for a long time supposed; and that, under certain circumstances, all the different organs, as well as their nerves, may attain their full development, notwithstanding the deficiency of the nervous centres. Indeed, it has been fully proved in several cases of anencephalia and amyelia, that the nerves may be perfectly developed independently of the existence of the brain or spinal cord. From these cases it appears that the nerves are primarily formed in those organs which it is their office to connect with the centres of the nervous system; and that they do not unite with those centres for a considerable time after their first rudiments are perceptible. (*Andral*, Op. cit.)

(*b.*) A diminution in the usual supply of blood, arising either from a reduction in the whole mass of the circulating fluid, as in phthisis, tabes mesenterica, and other diseases affecting the process of digestion and sanguification; or from any local obstruction to the arrival of arterial blood, as when the main artery leading to an organ is obliterated, or its caliber diminished: we have seen one of the kidneys in an adult as small as that organ usually is in the fœtus, and its blood-vessels proportionably diminutive. M. Lobstein records a case in which the spleen was no larger than a filbert, and the splenic artery so small as scarcely to admit a hair. In such cases, however, it is not always easy to determine whether the atrophy of the organ is in reality the cause or the effect of the atrophy of its artery; for we know that the arteries accommodate themselves to the size of the organ they are destined to support; increase with their growth, as in the pregnant uterus, and diminish with their diminution, as in the same uterus after delivery.

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* De l'Etat du Système Nerveux, &c. Journal de Physique, t. ix. p. 442.

(*c.*) A diminution in the nervous influence which regulates the movements, and presides over the powers, of assimilation and nutrition in the part. Thus in affections of the brain producing hemiplegia, we generally find the paralysed limb more or less wasted; and in all cases of injury to the nerves, the atrophy of the part to which the injured nerve is distributed invariably follows. The degree of atrophy is not, however, always proportional to the degree of paralysis, nor even to the length of its duration. In some cases, paralysed limbs become atrophied much more rapidly, and to a much greater degree, than in others. The cause of these differences it is not always easy to determine. It is probable that the various diseases of the nervous system which produce paralysis do not determine the atrophy of the paralysed limb solely by destroying the power of the will over the movements of the part, but that there likewise subsists a direct connection between the nutritive functions of the part, and the nervous influence which regulates its movements and internal operations; so that the capillary vessels, which are the parts more immediately engaged in the process of assimilation and nutrition, being held immediately under the control of the nervous influence, are, consequently, directly affected by any derangement or modification of the nerves which exert this influence over them. But even admitting this hypothesis, it still remains to be determined whether this influence of the nerves over the process of assimilation is exerted by all parts of the nervous system indifferently, or by one class of nerves in particular. We have examined the paralysed limbs of a great number of individuals, and have generally observed that in those cases where the paralysis arose from disease of the brain, the wasting of the paralysed limb occurred slowly, and was directly proportionate to the loss of motion in the part: whereas in those cases where the paralysis arises from an affection of the nerves of the part, the atrophy takes place much more rapidly, and is considerably greater than could be accounted for by the mere loss of motion. In several of the old and infirm paupers who have found an asylum in the Dublin House of Industry, and who have been hemiplegic for a number of years in consequence of cerebral disease, the wasting of the paralysed limbs is very inconsiderable, and indeed scarcely greater than would have occurred if the limbs had been voluntarily kept in a state of inaction during the same length of time. But in every case which we have had an opportunity of examining, where the paralysis arose from an affection of the nerves of the part, the atrophy which ensued was exceedingly remarkable, even though the loss of motion in the part were only partial. In cases of unreduced dislocation of the humerus, the pressure of the head of the bone on the brachial nerves produces a remarkable atrophy of the arm, even though the limb retains a considerable degree of motion. Mr. Bell relates two interesting cases of atrophy arising from local disease of the nerves. In one, "the muscles and ball of the thumb were wasted, so that the bones and the strings of the tendons over them might be felt quite plainly." In the other, he says "whilst the fore-arm is firm to the feeling as you grasp it, the muscles of the arm are wasted and loose, so that you can feel all the processes of the humerus from its upper to its lower end; the deltoid muscle is also quite gone." In commenting on these cases, Mr. Bell observes, (Appendix, p. 160.) "These affections of particular muscles, or classes of muscles, imply a very partial disorder of the nerves: a disease in the brain, or a disease in the course of a nerve, must influence the whole limb, or that portion of it to which the nerve or nerves are distributed. But in these cases, particular subdivisions included in the same sheaths, or running the same course, are affected."

Another example of the excessive wasting which occurs from affections of the nerves, is to be found in the paralysis which sometimes accompanies painter's colic.

We are acquainted with a gentleman whose arm was strained by an accident when he was a child; the injury was not attended to at the time, and the limb is now perfectly useless, and so wasted that it does not measure above one-third of the circumference of its fellow. M. Lobstein mentions a case somewhat similar. A man died at the age of fifty-four, with remarkable atrophy of his right leg, caused by a fall received when a child, by which the crural and sciatic nerves were severely injured. On dissection, all the soft parts and even the bones of the paralysed limb were found reduced to an extreme state of atrophy; the right femur weighed only three ounces two drachms and a half, whilst its fellow of the left side weighed nearly double. The gastrocnemius and soleus muscles of the sound limb weighed eight ounces, while those of the atrophied limb weighed only two ounces and six drachms. (Traité d'Anatomie Pathologique.)

This excessive state of atrophy not unfrequently follows when the nerves of the part are affected, but, we believe, seldom occurs to the same extent in cases of paralysis arising from disease of the brain: in the latter case the power of volition, and consequently of voluntary motion, is destroyed, and the part becomes atrophied from inaction in the latter. Not only the power of voluntary motion is lost, but the nervous influence, which regulates the action of the capillaries, and directly controls the functions of nutrition, is likewise injured, and the atrophy of the part follows in proportion. It must, however, be admitted that further investigations are required to enable us to account for the great varieties we observe in the different degrees of wasting in paralysed limbs: it is probable that some additional light may be thrown on the subject by investigating whether the nerves of sensation or those of motion are more immediately connected with the function of nutrition.

(*d.*) Another cause of atrophy is to be found in the diminished activity or total suspension of the natural functions of an organ. The effect of inaction on the muscular system has been already alluded to: a similar suspension of function is found to produce the same effect on the internal organs, in accordance with the general law, "that the development of an organ is directly proportioned to the activity of its functions." When one of the double organs, as, for instance, the lungs or kidneys, is incapacitated from acting, the other invariably acquires an increase of volume proportioned to its increased activity of function: the converse of this proposition is equally true, for when the functions of an organ are by any cause rendered less energetic than usual, it undergoes a proportionate diminution of volume. A remarkable illustration of this fact was observed by M. Renaud in the dissection of a monkey, and is described by Andral, (Op. cit. vol. ii. p. 456.) "An enormous ganglion, filled with tubercular matter, had so compressed the main bronchial tube of one of the lungs, that its cavity was almost completely obliterated; the lung to which it was distributed had undergone a remarkable degree of atrophy; and the thoracic parietes of that side had contracted and fallen in, as in the case of absorption of a pleuritic effusion." The atrophy of the testes in individuals who have lived in strict observance of their monastic vows, is a fact perfectly authenticated. Other instances might likewise be adduced, but these are sufficient.

(*e*.) The last cause of atrophy to which we shall allude is *inflammation*. We frequently observe an attack of inflammation succeeded by a marked degree of atrophy, or even by the total obliteration of the inflamed organ. In a soldier who had suffered from repeated attacks of hepatitis in India, we found, on dissection, the liver reduced to one-fourth its usual size, and composed principally of condensed cellular tissue. Andral mentions a case of suppuration of the gall-bladder, opening externally, and discharging several gall-stones, in which after death no trace of the gall-bladder could be found on dissection.* Inflammation occurring in an artery or vein not unfrequently causes the obliteration of its cavity, after which it speedily degenerates into a ligamentous cord. Another mode in which inflammation sometimes produces the atrophy of an organ, is by the pressure exercised by the product of the inflammation. Thus we find the lung atrophied by the pressure of the purulent fluid in empyema; and in chronic pericarditis the heart has been found corrugated on its surface, and greatly reduced in size.

As to the treatment best adapted for the removal of this morbid alteration, the first object of the practitioner should be to ascertain on which of the causes above enumerated the atrophy depends, and, if possible, to remove it; for unless we remove the cause, it will be in vain to attempt removing the effect; but when once the cause ceases to operate, the natural nutrition of the part will soon resume its wonted activity. It may, however, in general be promoted by such measures as are calculated to invigorate the system, exercise the functions, and sustain the temperature of the part.

R. Townsend.

AUSCULTATION.—In practical medicine, the term *auscultation* (from *ausculto*, to listen) is properly applied to all the methods used for discovering or discriminating diseases by means of signs having relation to the sense of hearing. It therefore comprehends the study of all sounds indicative of disease, in any part of the body, whether produced naturally or artificially, and whether perceived by the unassisted ear, or through the help of instruments.

The following synopsis includes all the important signs of disease recognised by auscultation.

I. *Signs derived from sounds produced naturally within the body.*

1. The sounds having their origin or seat within the chest.

a. Dependent on the motions of the heart.

b. Dependent on the motions of the lungs in respiration.

c. Dependent on the action of the vocal organs.

2. The sounds having their origin or seat within the abdomen.

a. From the peristaltic movements of the intestines when containing air.

b. From the pulsations of the fœtal heart.

c. From the movement of blood in the utero-placental arteries.

3. The sounds having their origin or seat in the arteries.

II. *Signs derived from sounds produced artificially, within the body or on its surface.*

1. The sounds produced by percussion of the surface.

a. Of the chest.

b. Of the abdomen.

c. Of other parts of the body.

2. The sounds produced by succussion of the body.

a. In the chest.

b. In the abdomen.

3. The sounds produced by the friction of the parts of a fractured bone.

4. The sounds produced by the contact of solid instruments with calculi in the urinary bladder.

It would seem, at first sight, most proper to treat first of the sounds naturally produced within the body. It will, however, be found more for the reader's advantage to notice previously the artificial sounds; because these are more simple and more easily understood, and because the knowledge of them will greatly facilitate the comprehension of the more complex results of the method applicable to the recognition of the natural sounds. For this reason we shall commence with those signs derived from percussion of the external surface of the body.

AUSCULTATION OF SOUNDS ARTIFICIALLY PRODUCED WITHIN THE BODY OR ON ITS SURFACE.

Percussion.—The application of percussion to the surface of the body, with the view of producing sounds whereby the physician might judge of the state of the subjacent parts, was first made about the middle of last century by *Leopold Auenbrug*, or *Auenbrugger*, a German physician, then residing at Vienna. This method, unquestionably one of the greatest improvements ever made in physic, was announced to the world in a small volume, in Latin, first published in the year 1761. In his little work the author scarcely notices the principles upon which the method is founded, and gives us no insight respecting the circumstances attending its discovery. The new means of diagtion of the full sound, that the walls of the cavity be kept in as elastic a state, that is, as tense as possible; just as it is necessary to brace tightly the parchment on a drum or tambourine before beating it. With this view, we make the patient assume such positions as stretch the skin and muscles covering the walls of that portion of the chest we are going to percuss.* Accordingly, when practicable, it is desirable that the patient should be seated, and not lying down during the operation. If confined to bed, and able to sit up in it, he should do so; if quite able to get out of bed, he should rise and be seated on a stool. When we operate on the fore part of the chest, we cause the patient to raise the head, and throw the shoulders forcibly back. When we operate on the back, we cause him to stoop the head downwards, and to cross the arms, so as to render the whole back rounded or arched. When we percuss the side, we desire the arm of that side to be raised above the head, and the body to be inclined to the opposite side; and, on the same principle, we are careful that the garment over which we percuss is drawn very tight across the part, and is kept in very close apposition with the surface; and, by means of the fingers of the left hand, we can frequently not merely do this, but even aid the efforts of the patient to stretch the skin and muscular fibres beneath.

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* One of the Editors was witness of a similar result in the case of a right reverend prelate, who died at a very advanced age, having suffered from the disease noticed in the text a great many years before his death.

In operating, we prefer to strike a bone, as the sound is greater than when we strike on softer and less elastic parts; but this is a rule which neither can nor should be always adhered to. A rule, however, which must never be forgotten or infringed, in percussing comparatively both sides, is to strike on similar substances, and, as nearly as possible, on exactly corresponding points, and also with the same degree of force, and under a similar angle. Inattention to any of these circumstances is very apt to mislead beginners.

It is also right for the student to be aware that not merely the posture of the patient, but his situation relatively to other bodies, will modify the sound. Thus, bedding and bed-furniture, also carpets, and other bodies that deaden sound in general, will render that elicited from the chest less clear; also the size of the room, &c.; just as is observable in the case of musical instruments. But, although it is well that the practitioner should not be ignorant of this circumstance, it can seldom materially affect our practical conclusions.

II. **Mediate percussion** was only introduced into practice a few years since, by Mr. Piorry, a young physician of Paris, and differs chiefly from the foregoing in the employment of a small plate of ivory (named by him pleximeter†) laid flat upon the surface, upon which plate the percussion is made.

If the bodies to which we apply percussion are hard, and more or less elastic, nearly similar results as to sound will be obtained, whether we apply the blows directly to their surface or to a thin plate of any solid and elastic substance laid upon them. In both cases, the character of the sounds elicited will depend upon the nature of the body under the part percussed. The degree of sound, however, will be considerably modified according as the body to be percussed differs much or little from the plate upon which the percussion is made. If the body differs little from the plate in solidity and elasticity, the sound will be nearly the same whether percussion is made on this or on the plate; but if the body is soft and inelastic, the difference of sound in the two modes of percussion will be very great. When we apply percussion to a solid and elastic body, the sound elicited is the result, not merely of the direct primary impulse on the surface, but of the combined vibrations of the whole mass of matter beneath it. The primary sound immediately produced by the blow will, therefore, be greatly modified by the latter, and the modification, as appreciated by the ear, will be received as the one sound produced.

But if percussion be practised on a soft and inelastic surface, the impulse will not be propagated to the interior, and therefore will elicit no resonance from it. In such a case, however, we have nothing more to do than to make a firm surface, by covering the part with a thin lamina of any solid, such as the plate of ivory before mentioned. This closely applied to a body becomes as a part of it, and the sounds easily elicited by percussion upon it, derive their character from the state of the subjacent parts.

The firmness and tension of most parts of the thoraric parietes supersede the necessity of using a pleximeter on them; but some spots are covered with a considerable thickness of soft parts, and on these it is necessary for the proper exercise of percussion; and the same may be said when the parts become thickened or painful from disease. In the percussion of the abdomen, possessed as it is of soft and yielding walls only, the pleximeter is absolutely necessary to the production of the requisite degree of sound; and it is yet further necessary, in many cases, in order to bring the superficial walls, by pressure, in contact with the subjacent parts. (See EXPLORATION OF THE ABDOMEN.) Mediate percussion alone may therefore be said to be applicable to the investigation of abdominal diseases. It is at least equally applicable with direct percussion to the chest; and as it has decided advantages in some cases, and no other disadvantage in any case than the necessity of having an additional instrument, it ought to take precedence of the original method of Auenbrugger in the investigation of pectoral diseases also.

The following are the relative advantages and disadvantages of the two methods, as stated by M. Piorry. 1. Direct percussion is often painful, particularly in unskilful hands; as when the blows are too forcible, when they are applied upon the soft parts between the ribs, or when the nails are prominent: even, in some cases, the degree of impulse necessary to produce sufficient sound excites either a sense of pain on the skin, or a painful jarring within the chest, occasionally lasting some time. The use of the pleximeter enables us to avoid all these inconveniences; in the first place, because it defends the skin from the direct impulse of the fingers; secondly, because a less degree of impulse is necessary to produce the requisite sound; and, thirdly, because the shock is much less felt from being equally diffused over a considerable space. Even in the case of recent vesications, the interposition of the plate will frequently enable us to employ percussion with little or no inconvenience to the patient. 2. As the walls of the thorax consist of very different materials in different places, and vary likewise greatly as to their thickness, &c. direct percussion can only be effective when made on the more solid points of the thinner parts of the parietes; namely, the sternum, clavicles, ribs, and their cartilages: when made on the intercostal spaces, pectoral muscles, or mammæ, it is both painful and ineffective; and when there is a great accumulation of fat below the skin, or the parts are anasarcous or emphysematous, the sound is still more imperfect. Mediate percussion will enable us to get over most of these difficulties. By means of the interposed plate we can percuss equally on the bone and soft parts; and the precaution so requisite in direct percussion to percuss on similar parts on both sides, becomes unnecessary, the plate constituting a sort of artificial solid wall to the soft parts. In the case of anasarca or emphysema, by compressing the distended parts with the plate, we obtain a solid point whereon to employ percussion, and thereby obtain results otherwise unattainable. 3. Mediate percussion is much easier, and requires much fewer precautions than the ancient method. In direct percussion we must never lose sight of the rule that the percussion must be made precisely in the same manner on the two opposite sides of the chest, to enable us to deduce safe conclusions from the resulting sounds: for instance, the blows must be made on similar structures, with the same degree of force, under the same angle, &c. With the pleximeter these precautions are much less necessary, because we have here always the same flat smooth surface whereon to strike, and an artificial wall everywhere of equal density and elasticity. Besides, less art is necessary in arranging the fingers in the latter case, a single finger being in general sufficient to elicit the necessary degree of sound.

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* This is less necessary in mediate percussion; indeed it is often proper, in this method, to keep the muscles relaxed.—*Piorry*, Du Procédé Operatoire. 1830.

† *Measurer of percussion*, from πλέξις, *percussio*, and *μέτρον, modus.*

In admitting the validity of these advantages of mediate over direct percussion, we must allow that the superiority of either in practice will depend greatly on experience. By one well versed in direct percussion, an instrument will not often be needed in the exploration of the chest, as his experience will enable him to evade most of the inconveniences attending the former. The necessity of carrying an instrument, however portable, will be felt by some to be an inconvenience; but this can never be admitted as a reason for rejecting the employment of a method which possesses decided advantages.

There is a variety of mediate percussion in common use still more simple than that of Piorry's, and which is well deserving the attention of the student. This consists of the substitution of one or two fingers of the left hand for the pleximeter,—the *back* of the fingers being uppermost. This proceeding possesses several of the advantages of M. Piorry's method; and it has even some few over it, exclusive of its greater simplicity. In cases where there is considerable emaciation, M. Piorry's method is liable to mislead, unless the intercostal spaces are carefully filled with some soft material; as, without this precaution, the sound may be modified by the hollow existing between the plate and the skin. Direct percussion on the ribs, or the employment of the fingers as a pleximeter, is often, in such cases, preferable. If we are careful in applying the fingers so as to make them fit accurately into the natural depressions, and thus form one body, as it were, with the thoracic parietes,—we are often enabled to use very forcible percussion without exciting pain, and also to elicit as definite sounds as by either of the other methods. This proceeding is free from another inconvenience which occasionally attaches to M. Piorry's method, especially in the hands of beginners. In the latter it sometimes happens that the loudness and sharpness of the primary sound arising from the contact of the two surfaces, are so considerable (particularly if the *nail* be used, which it ought never to be) as to drown, as it were, the secondary sound resulting from the modifying influence of the subjacent parts, from which modification it is that we form our judgment respecting the condition of those parts. When the fingers constitute the pleximeter, we have little or none of this immediate *clatter* when the blow is given.

[Various instruments have been devised for pleximetric percussion by Drs. Burne, Winterich, Bigelow, C. J. B. Williams, and others; (Dr. C. J. B. Williams, *Lond. Med. Gaz.*, Dec. 16, 1842; and, Gerhard, *Lectures on Diseases of the Chest*, p. 21: Philad. 1842); but, after all, for general purposes, the forefinger of the left hand, with the palmar surfaces to the chest, as mentioned above, makes the best pleximeter. The sounds rendered will be more distinct if the patient holds his mouth open, whilst the chest is struck.]

Whichever method we employ, it is of the utmost importance that the operator be fully acquainted with the relative sonorousness of the different parts of the chest in the state of health. This knowledge must be founded on an accurate acquaintance with the topographical relations of the external and internal parts, and can only be acquired by experience. In the article EXPLORATION OF THE CHEST, these relations are fully detailed. At present we can do little more than refer to it for information. We shall only here remark that the degree of natural sonorousness is, in all cases, dependent on the anatomical structure of the external parts, and the nature and relative position of the organs placed beneath them respectively. The thinner and tenser the parietes, the greater the mass of the air-filled pulmonary substance beneath, and the closer it approaches the surface—the greater will be the natural resonance on percussion, and *vice versâ*. A little practice on the healthy chest will make the student master of this subject; and he will find his progress much facilitated by the artificial plan in common use of mapping out the surface into different *regions*. A knowledge of this plan will not merely fix more firmly and clearly the subject in his own mind, but will enable him much more readily to communicate his information to others. (See *figures* in the articles ABDOMEN and CHEST, EXPLORATION OF THE.)

Independently of the relative sonorousness of different parts in the same chest, general differences occur in different individuals, which it is not always easy to account for; some chests being very sonorous, and others comparatively dull. This might be expected, *à priori*, when the complexity of the structure of the contained and containing parts is considered. The greater or less degree of robustness, fatness, &c. has certainly an obvious effect; lean persons having always, *ceteris paribus*, more sonorous chests than those who are fat. This is one reason why percussion frequently fails to detect the presence of tubercles in the lungs, the increase of sonorousness from the extenuation of parietes compensating for the augmented dulness of the viscus within. In children generally, the chest is very sonorous. This may partly arise from the small degree of development of their muscles, and the absence of fat; but it is probably, also, in part owing to the peculiar relations of the lungs to the air, in this age.

The sounds elicited by percussion from the chest in the state of health may be changed by disease in various ways,—in degree, in kind, and in their respective site.

It is, however, necessary to be aware that many and important morbid conditions of the thoracic viscera occasion little or no alteration in the sound. This will be the case so long as the physical alterations which attend the disease have not materially affected the proportion of air naturally within the chest in a state of health. Thus, in bronchitis; in the first stage of pneumonia; in pleurisy attended by very slight effusion; in that form of pneumonia termed interlobular, in which the morbid change may only occupy a small point in the centre of the lungs; in the early stages of phthisis when the tubercles are disseminated through the pulmonary substance; in diseases of the heart and pericardium, without augmentation of size; in nervous and neuralgic affections, &c.; there will either be no change in the sound, or the change will be so slight as to be appreciable by few observers, and consequently not to be generally admitted as a sign in practice. That there must, in reality, be a change in the sound in all the foregoing cases in which any change has taken place in the relative proportions of the solid and aerial matter naturally contained within the chest, cannot be doubted; but as the natural imperfection or defective cultivation of our auditory sense prevents the detection of this, the result is practically the same as if no change existed.*

The natural degree of resonance will be perceptibly diminished whenever the proportion of air, usually existing in the lungs, is lessened by the addition of matters of greater density. The degree of diminution of the natural sound may vary from the slightest perceptible dulness to the completest deadness, or total abolition of the tympanitic resonance characteristic of the presence of air in a cavity. In the slightest degree, the dulness cannot be ascertained to be morbid from its actual but from its comparative amount; and an opinion will not, therefore, be formed respecting its character and indications, until after we have percussed the rest of the chest, particularly the corresponding parts of the opposite side. In the greater degrees of dulness, particularly when amounting to the complete fleshy or dead sound, the simple percussion of the part suffices instantly to reveal disease.

The morbid matters which take the place of air within the chest, and thereby produce the diminution of sound, may exist either in the substance of the lungs, or exterior to these. The following are the principal alterations within the substance of the lungs: hepatization in its different forms and stages; pulmonary apoplexy and œdema when of considerable extent; tuberculous degeneration or induration; foreign growths displacing and compressing the pulmonary substance, such as cysts, melanosis, encephaloid tumours, &c. Exteriorly to the substance of the lungs are all the varieties of effusion or accumulation of liquid in the pleura; (pleurisy, hydrothorax, hæmathorax;) tumours of different kinds developed in the cavity of the pleura or mediastinum; diseases of other organs, such as hypertrophy of the heart, hydropericardium, aneurism of the aorta, and even enlargement of the liver, &c. In the case of accumulation of liquid in the pleura, the dulness of sound may originate either from the exclusion of part of the air naturally contained there, or from the interposed layer of liquid preventing the transmission of the sonorous vibrations to and from the air in the lungs, on account of the different density of the media.

The only cases in which the natural resonance of the chest is increased in disease, are dilatation of the air-cells (pulmonary emphysema of Laennec,) pneumothorax, and certain rare cases of tubercular excavation. In all those instances the sound is increased because the natural proportion of air is increased, just as in the preceding instances it was diminished by the diminished proportion of the aerial contents. In emphysema, the morbid sonorousness commonly exists on both sides of the chest; in pneumothorax it is, we believe, always confined to one side. The only form of tubercular excavation which considerably augments the natural sonorousness, is that in which a cavity occupies the greater part of one lobe or two lobes, and contains but little liquid secretion. In cases of this kind the sound is sometimes a good deal altered in kind as well as in degree, having something of a metallic resonance, as if elicited from a flask or cup of metal.

In the different articles in the present work which treat of the individual diseases of the chest, the practical application of percussion as a diagnostic measure will be set forth at length: any detail on such points would, therefore, be superfluous on the present occasion.

Percussion of the abdomen. (See ABDOMEN, EXPLORATION OF.)

Percussion of other parts of the body.—It does not appear that percussion of any other parts of the body beside the chest and abdomen is likely to lead to any results of value. In almost all affections of the limbs and external parts of the body, other modes of physical exploration, particularly manual examination, will supersede the necessity of this method. The only cases in which it seems to offer any chance of being useful, are—tumours in the maxillary and frontal sinuses, and hernia. In the former cases, it is probable that a well-instructed ear would be enabled, by mediate percussion, to ascertain whether the sinuses were empty or filled with solid matter; and in a case of hernia, no doubt a piece of intestine filled with air would yield a different sound from one filled with omentum. In doubtful cases, also, of swellings in the groin, this measure might assist in discriminating an enlarged gland or other external tumour from hernia, certainly from an intestinal hernia. But it can rarely happen to the surgeon to require assistance of this kind; although the fact that the true diagnosis has only sometimes been made on the operation-table, shows that the proposal to seek aid from auscultation in such cases is not altogether absurd. Piorry asks whether in croup the larynx and trachea, which naturally yield a clear sound with the pleximeter, will not give a dull one when occupied by the false membrane of croup! This seems probable, but what is the information worth?

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* M. Piorry scarcely admits the necessity of the qualifications above mentioned: his experience and fact are, however, much beyond the ordinary standard.

Succussion.—This term is applied almost exclusively to a method of exploring pectoral affections mentioned by Hippocrates. It consists in forcibly shaking the patient's body, and observing the sounds thereby produced. It has been also sometimes used in the investigation of abdominal diseases. There is only one class of cases in which this method can be productive of any results, namely, where there is contained both a liquid and a gaseous fluid in an internal cavity: and the only instances in which such a combination occurs are the following:—1. pneumothorax, in which there is an effusion into the cavity of the pleura both of liquid and air; 2. a large tuberculous cavity in the lungs containing also pus or other liquid, and air; 3. an accumulation of a liquid of any kind, and of gas, in the stomach or large intestines. The principle upon which the sounds are excited by succussion in those cases is sufficiently obvious: it is precisely the same as operates when we shake a bottle or bladder filled partly with water and partly with air. The rapid and forcible intermixture of the two fluids of different density, and the impulsion of the heavier of the two against the walls of the containing vessel or part, give rise to the sound of fluctuation. In pneumothorax, this sound is frequently perceived in the most distinct manner; and as it is a pathognomonic sign of this disease, it becomes of great practical value. This sign was well known to Hippocrates, and is distinctly noticed in several parts of the writings that usually pass under his name. He appears, however, to have regarded it as a sign of simple empyema; being unaware of the fact that the presence of air is absolutely necessary to the production of the sound of fluctuation. In empyema and hydrothorax, no degree of succussion gives rise to any sound; as, indeed, must be evident to any one who regards the principle on which fluctuation depends.*

Morgagni likewise notices the practice, but in a manner that proves his want of practical acquaintance with it. It is to Laennec that we are indebted for the true account of the principles on which it is founded, and for the just appreciation of its merits. As already stated, succussion is a most valuable sign in pneumothorax; and as this disease is now known not to be extremely rare, there are no grounds (as Laennec observes) for leaving this method in the oblivion into which it has fallen. The mode of performing succussion is the same as practised and recommended by Hippocrates. The patient, seated in a chair or in bed, is to be quickly, yet not violently, shaken by the shoulder, the operator stopping the succussion suddenly, and listening for the sound of fluctuation. In the proper cases this is heard most distinctly, and when so heard can never be mistaken for any thing else. We have heard it quite as distinctly while the patient was in the act of rising or lying down. The cases of tubercular phthisis without pneumothorax, in which succussion produces the sound of fluctuation, are very rare. Laennec says he never met with but one case of the kind. The result can only be expected when the excavation is extremely large, and contains a great quantity of pus as well as air. The sound of fluctuation in the stomach is very readily produced in many persons who have recently drunk much fluid, by the ordinary movements of the body. This becomes still more perceptible on succussion of the trunk. It has been attempted to apply this sign as a means of diagnosis in disease of the pylorus; but it is worthy of no consideration, inasmuch as there are many others greatly superior in certainty, and therefore in value.

Auscultation of sounds artificially produced has been applied successfully to certain surgical diseases, particularly to the discovery of doubtful fractures and the detection of stone in the bladder. The nature of this work prevents any detailed account of cases of this kind: they are merely referred to on the present occasion with the view of directing the attention of the surgical student to the works which give an account of them.†

AUSCULTATION OF SOUNDS NATURALLY PRODUCED WITHIN THE BODY.

This division of our subject is almost exclusively confined to the investigation of the sounds which originate within the chest; those having their site in the abdomen or elsewhere being of comparatively trifling importance. The remainder of this article will, therefore, be in a great measure devoted to the consideration of the physical signs supplied by auscultation of the thoracic sounds.

It is a singular fact that Hippocrates, upwards of two thousand years ago, endeavoured to ascertain the existence and nature of diseases of the chest by means of auscultation, that is, by the sounds produced by their presence within the chest. "You will know by this," he says, "that the chest contains water and not pus, if, on apply-

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[*] Many passages in the writings of Hippocrates prove that the practice of succussion must have been both a common and a successful means of diagnosis in the time of that physician. We can only, in this place, refer to some of these. We quote the edition of Vanderlinden:—*De Morbis* lib. I. v. tom. ii. p. 6. *De Morbis* lib. II. xliv. tom. ii. p. 69. *Ibid.* xlv. p. 70. *Coac. Prenot.* tom. i. p. 565. *De Locis in Hom.* xxvi. tom. i. p. 379. *Ibid.* xxviii. p. 380.

[†] See in particular *Laennec*, Aus. Méd. tom. i. p. 117; *Lisfranc*, Mémoire sur les nouvelles applications du stethoscope; and *Alcock's* translation of the latter.

ing the ear for a certain time to the side, you hear a sound like that of boiling vinegar." Many other passages in the writings that commonly go under his name, refer to the same means of detecting diseases.

It hardly detracts from the merit of this great man, that, in the particular instance mentioned, his diagnosis is not true. Owing to a prohibition of dissecting dead bodies, which existed in his time, it was scarcely possible to be accurate in such a case. The merit of the discovery of auscultation, or, at least, the merit of having first attempted to discover diseases of the chest by means of auscultation, is unquestionably his; and the chief object of the present article is to show to what a wonderful degree of usefulness this discovery was subsequently carried by a kindred genius, two-and-twenty centuries after it was first made.

It would appear that the practice of auscultation in any of its forms, as employed by the Asclepiades, had almost entirely fallen into disuse, and even oblivion, with modern physicians, until a very recent period. Laennec informs us that, previously to the discovery of the stethoscope, he himself, Bayle, and others, were in the habit of applying the ear to the side in studying diseases of the heart; and we learn from a work of M. Donble, published two years previously, that this physician was accustomed to employ the same means in exploring diseases of the lungs. Speaking of the signs furnished by respiration, and of the sounds produced by it within the chest in disease, he says that, with the view of hearing them more distinctly, "we must apply the ear closely to every point of all its aspects; by which means we can distinguish not merely the kind and degree of the sound, but even its precise site." He adds, "I have frequently derived great benefit from this mode of investigation, which is peculiar to myself, and to which I was naturally led by the employment of the like method in exploring the pulsation of the heart."* Long before this period, indeed, one of our own countrymen, not of the medical profession, and who, in all probability, was unacquainted with the writings of Hippocrates, was fully aware both of the existence and great importance of internal sounds as a means of diagnosis, and, as Dr. Elliotson well observes, seems almost to have prophesied the stethoscope. We quote the passage as extremely curious in the literary history of auscultation. "There may be a possibility," says Hook, "of discovering the internal motions and actions of bodies by the sound they make. Who knows but that, as in a watch we may hear the beating of the balance, and the running of the wheels, and the striking of the hammers, and the grating of the teeth, and multitudes of other noises;—who knows, I say, but that it may be possible to discover the motions of internal parts of bodies, whether animal, vegetable, or mineral, by the sound they make; that one may discover the works performed in the several offices and shops of a man's body, and thereby discover what engine is out of order, what works are going on at several times, and lie still at others, and the like." "I have this encouragement not to think all these things utterly impossible, though never so much derided by the generality of men, and never so seemingly mad, foolish, and fantastic; that, as the thinking them impossible cannot much improve my knowledge, so the believing them possible may, perhaps, be an occasion for taking notice of such things as another would pass by without regard as useless. And somewhat more of encouragement I have also from experience, that I have been able to hear very plainly the beating of a man's heart; and it is common to hear the motion of the wind to and fro in the guts and other small vessels: the stopping in the lungs is easily discovered by the wheezing." "As to the motion of the parts one among another—to their becoming sensible, they require either that their motions be increased, or that the organ be made more nice and powerful to sensate and distinguish them as they are; for the doing of both which, I think it is not impossible but that in many cases there may be helps found." (Hook's Posthumous Works, p. 39, et seq.)

There is no reason to believe that Laennec was acquainted with these opinions of the English philosopher; nor, if he had, would this knowledge, any more than that which he derived from the writings of Hippocrates, have greatly detracted from his merits as the discoverer of mediate auscultation, and the inventor of the stethoscope.

This great man was born in Bretagne, in France, in the year 1781, and early devoted himself to medicine. He commenced his studies in Nantes, and proceeded to Paris in the year 1800, in order to complete them. He there followed up his professional pursuits with all the enthusiasm of genius; devoting himself more especially to the investigation of the nature and signs of disease, in imitation of his master, Corvisart. Under the guidance of this great physician, he became a zealous and successful investigator of chest-diseases, by means of percussion; and, while he proved its full value, he soon became sensible of its imperfections, more especially in diseases of the heart. In cases of this kind, young Laennec and several of his fellow-pupils were accustomed, in imitation of Hippocrates, to apply the ear to the chest, in the hope of thereby aiding their diagnosis. He informs us that from these trials he derived little practical benefit; but it was from them that he was led to a discovery of the very greatest importance. This was the discovery of *mediate auscultation;* his account of which we shall give in his own words:

"In the year 1816," he says, "I was consulted by a young woman affected with the general symptoms of diseased heart, and in whose case percussion and the application of the hand were of little avail, owing to her being extremely lusty. The immediate application of the ear being inadmissible for obvious reasons, I happened to recollect a simple and well-known fact in acoustics, and fancied it might be turned to some use on the present occasion. The fact I allude to is the great distinctness with which we hear the scratch of a pin at one end of a piece of wood on applying our ear to the other. Immediately, on this suggestion, I rolled a quire of paper into a kind of cylinder, and applied one end of it to my patient's chest, and the other to my ear, and was not a little surprised and pleased to find that I could thereby perceive the action of the heart in a manner much more clear and distinct than I had ever been able to do by the immediate application of the ear. From this moment I imagined that means might be found to ascertain the character, not merely of the action of the heart, but of every species of sound produced by the motion of all the organs within the chest." (De l'Auscult. Méd. tom. i.)

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* Semeiologie Générale, par F. J. Donble, tom. ii. p. 31. Paris 1817.

With that intuitive glance into the latent capacities of things, which only belongs to inventive genius, Laennec at once foresaw the great outlines of the discoveries which were afterwards evolved by his persevering industry; and he set to work with a zeal and enthusiasm worthy the great object he had in view, and with a degree of success and fertility of results much more remarkable than the discovery itself. At this time he was physician of the Necker Hospital in Paris; and he forthwith instituted in its wards a series of observations and experiments on the new method of diagnosis, which were hardly interrupted for one single day, until the discovery may be said to have been almost perfected in his own hands. He first gave an account of his method to the Academy of Sciences, in 1818, and, in the following year, he published his immortal treatise "De l'Auscultation Médiate et des Maladies des Poumons et du Cœur."

In announcing this work, he boasted that "he had been enabled to discover a set of new signs of diseases of the chest, for the most part simple, prominent, and certain, and calculated, perhaps, to render the diagnosis of these diseases as positive and circumstantial as that of many affections which come within immediate reach of the hand or instruments of the surgeon." And it must be allowed that this boast is in a great measure justified by the wonderful precision introduced by him into this department of medicine.

The first object of Laennec after his discovery, was to improve and perfect the rude instrument he had used in his primary explorations; and, after many trials, he finally invented and adopted that which is now in general use. This instrument he denominated *the stethoscope*, (from στῆθος, *pectus*, and σκοπέω, *exploro*.) It is now so well known that it is unnecessary to give any description of it. On a future occasion, we shall have to notice the principles on which it is constructed, (see STETHOSCOPE;) but before we can comprehend these, or the manner of using it, it is expedient that we should be made acquainted with the nature of the sounds which it is intended to convey to the ear.

As every form of matter is susceptible of the vibrations which, when falling on the ear, give the sensation of sound; and as the motion of most bodies, when accelerated to a certain degree, excite these vibrations either in themselves or contiguous substances, it might be expected, *à priori*, that the thoracic organs, being in constant motion, should, in the performance of their functions, give rise to sound; and that they have been observed to do so, at least when diseased, is sufficiently evinced by the existence in all languages of such expressions as "wheezing on the chest,"—"rattle in the throat,"—"hearing the heart beat," &c. But no attempt was made to classify or analyze the sounds before the time of Laennec.

The motions that naturally take place within the chest are those of the lungs and heart, in performance of the functions of respiration and the circulation of the blood; and both these give rise to audible sounds of various kinds and in different ways.

From what we know of the effects of currents of air in producing sound when passing through narrow channels, or when partially impeded and interrupted, as by the branches of a tree, for example, we should expect that the incessant passage of air through the tubes and cells of the lungs, together with the constant dilatation and collapse of these, would be productive of very audible sounds, if the ear could be brought sufficiently near their source. At first, indeed, we might be led to consider them as altogether cut off from our auditory sense by the solid barriers of the chest; but when we come to reflect that the surface of the lungs is always, necessarily, in close contact with the inside of the walls of the chest, and that these walls are only from a quarter to half an inch thick, and consist of substances favourable for the transmission of sound, we are at once prepared to expect that the sounds in question may be audible through the thoracic parietes: and such is the fact. If we place our ear in close contact with the chest of any person while breathing, more particularly a child, we can distinctly hear sounds, synchronous with inspiration and expiration, on every part of the surface that lies over the lungs. Although sufficiently audible, these sounds are still only feeble in degree; and emanate, with nearly equal intensity, from almost every point of the surface of the chest. It is these qualities of comparative feebleness and equal diffusion over the chest, that prescribe one of the uses and forms of the stethoscope—that, namely, in which it fulfils the office of a common ear-trumpet. In this case, the instrument consists of a cylinder of wood, perforated longitudinally by a bore of nearly the same size as the auditory canal, and swelling out at the farther extremity into a funnel-shaped excavation, like the extremity of a clarionet or bugle. When this is placed upon any part of the surface of the chest, the ear, applied to the other extremity, will receive the whole of the respiratory sounds emanating from that portion of the chest included within its circumference—the sonorous vibrations, or rays of sound, (if we may be allowed the expression,) being concentrated by the funneled extremity, and conveyed along the tube to the ear. An instrument of this kind, then, is the best for exploring the sounds produced by respiration simply, whether in health or disease. But Laennec found sufficient reason, in his progress, to modify this, the simplest, and for respiration the best, form of the stethoscope.

In following up his researches, he discovered that the sounds produced by the voice within the chest are of great importance as signs in several forms of disease; and he ascertained by experiment, that the particular sounds which are of most value, are best conveyed to the ear by a cylinder perforated by a bore of an equal caliber throughout. In order to avoid the multiplication of instruments, (a thing always to be avoided when practicable,) he conceived that the same trumpet-shaped cylinder might be made to answer the requisite end, by having fitted to its wider extremity a moveable plug, of the same materials, traversed by a perforation of the same diameter as that of the upper portion of the instrument. And he found, on trial, that this answered perfectly.

The only other organ within the chest, which, in the performance of its natural functions, produces audible sounds, is the heart. These sounds, as every one knows, are very perceptible by the naked ear when placed in contact with the surface of the chest on the left side. There still exist doubts among physiologists as to the precise cause of these sounds, and many different theories have been promulgated with the view of explaining them. Some account of these explanations and opinions will be given in the sequel. It is sufficient for our present purpose to observe, that in the exploration of the heart, a solid cylinder is preferable to a tube, because we here require to judge, not merely of the sound, but also of the shock or impulse communicated to the walls of the chest; and for the conduction of impulse, a solid body is obviously superior to a mere tube. But here, again, the wish of avoiding the multiplication of instruments led the inventor of the stethoscope to be contented with such a form as was found practically sufficient, though not theoretically the most perfect, for the exploration of the heart—namely, the cylinder with the infixed plug or stopper, such as is used in the exploration of the voice.

In the common form of the stethoscope, then, we possess an instrument suited for the exploration of all the sounds produced within the chest; and we may remark, that so long as the fundamental principles on which it is constructed are attended to, its external configuration is comparatively of little moment.

The manner of using the stethoscope is extremely simple. The only precautions necessary are, to keep its pectoral extremity always in exact contact with the surface on which it rests, and to preserve the auditory canal of the ear in accurate communication with the perforation in the instrument. With the view of ensuring its more perfect apposition, the hand that holds the instrument is kept close to its further extremity, in such manner that the little and ring fingers may be employed as tentacula, or feelers, in regulating its application. A reference to the principles of its construction will point out the absolute necessity of keeping the whole of its pectoral extremity in contact with the surface; and on this account it must never be inclined from its perpendicularity to the surface of the chest in order to accommodate the convenience of the operator: the ear must be moved to suit the instrument, not the instrument to suit the ear.

The stethoscope may be applied either to the naked chest or over the clothes; as it is found that a moderate thickness of a body of the density of cloth has only a very inconsiderable effect in diminishing the intensity of the sounds. In certain cases, indeed, as in very lean and deformed subjects, it is quite necessary that the part we are examining should be covered, in order to give to the instrument that perfectly smooth and level resting-place so essential to its proper action. In some cases of this kind it is even necessary to apply small compresses of linen in order to fill up inequalities.

As during percussion, and, indeed, more so than in that case, there must be no noise in the patient's chamber or its immediate vicinity during our exploration with the stethoscope. At least, this precaution is necessary for beginners; although the ear that is accustomed to the sounds, will learn to catch them amid others that are much louder, just as various artisans accustomed to live amid the noise of machinery, are able to converse without any great elevation of voice.

A very few words suffice to state in what way the stethoscope becomes, in the hands of an expert auscultator, the means of an accurate diagnosis. By it we learn that the motions of the lungs and heart, in a state of health, produce certain determinate sounds in certain parts of the chest; and that these sounds are modified in certain determinate ways, and certain other determinate sounds superadded, in states of disease: by the study of the symptoms during life, by dissection after death, and by considering the principles of the generation of sound, we are able to connect, as cause and effect, particular forms of disease with particular sounds; hence the indications of the stethoscope, in certain diseases, become positive physical signs of these diseases.

We shall occupy the remainder of the present article in illustrating this proposition, which involves the whole doctrine of auscultation as a means of diagnosis.

Auscultation of the Respiration.

I. *Of simple respiration, natural and morbid.* —The sound of healthy respiration, as discovered by the stethoscope, is somewhat different in different parts; having one character in the pulmonary cells, another in the larger bronchial tubes, and another in the trachea. The common character of all these may be said to be that of a prolonged hiss or puff—such a sound as is produced by blowing forcibly into or through a small opening, and not very unlike the blast from the nozzle of a pair of bellows.

That which originates in the pulmonary cells (and which may be denominated *pulmonary, cellular,* or *vesicular,*) is perceptible, in health, over every part of the chest with which the lungs are in contact. It is such as we might expect to be produced by the rapid passage of air through a congeries of minute tubes and cells, composed of a thin and moist membrane; viz., a low monotonous sound, almost exactly like that of a person breathing through the nostrils in a placid sleep, only feebler. It is a double sound; or rather there are two sounds; the one corresponding with inspiration, the other with expiration; and the former is usually much stronger than the latter. We may produce sounds artificially, or may imagine sounds more or less resembling this; but, of course, it must be heard in order that a perfect idea of it can be communicated to the mind. And this is best done, in the first instance, by the application of the unarmed ear to the chest of a child, as the sound is naturally louder in children. We recommend the naked ear in the first instance, because it requires some little practice to use the stethoscope, and because the mere application of this to the ear occasions a rustling noise, which might possibly be mistaken by the student for the sound he is in search of. When once heard distinctly, this can never be mistaken.

The sound produced in the trachea and larger bronchi is, as formerly mentioned, somewhat different from that produced in the pulmonary cells; although it is not easy to describe the difference. In the pulmonary or cellular respiration already noticed, there is a character of slight crepitation, or roughness, as if from accompanying moisture, which is wanting in the bronchial and tracheal kind; and these latter, likewise, convey the impression as if they originated in a larger space. The principal difference between the tracheal and bronchial respiration consists in the idea of larger caliber being suggested by the former. In a state of health, the bronchial respiration can only be heard in the very largest bronchi.

It is only by experience that we can acquire a perfect knowledge of the sounds of healthy respiration; but having once acquired this knowledge, it becomes easy to discover when this natural character is changed. This change only arises from disease; and it is the great object of the practical auscultator to detect the morbid sounds, and to trace them to their causes in physical changes of structure within the chest.

It has been already said that, in the state of health, the sound of pulmonary or cellular respiration is perceived over every part of the chest with which the lungs come in contact. We are thus enabled, in the living body, to trace the boundaries of these organs with the greatest accuracy. These boundaries, generally speaking, are the same as are indicated by the circumscription of the sonorous sphere in the trial of percussion. As in the case of percussion, also, the intensity of the sound varies in different parts of the chest; and the relative intensity of the sound in different parts generally corresponds in both forms of exploration, the respiratory sound being loud where that of percussion is clear, and *vice versâ.* Accordingly, we may state the following to be the parts where the respiratory sound is perceived the most readily and most constantly: the axilla, the top of the shoulder above the clavicle, the subclavian region before, and the subscapular region behind. In general, the respiration is loudest on the anterior parts of the chest.

When the respiratory sound is perceptible over all its natural sphere, and with its natural characters, we may be assured that there exists no disease within the chest which materially affects the lungs; we may be certain, at least, that the air-cells are neither obstructed by fluids poured into them, nor by compression from without. When the natural sound is altered, or no longer exists, we may be assured that disease is present.

[It is important to bear in mind, that difference of sentiment exists as to the comparative inspiratory murmurs of the two sides under the clavicles, which are the common seat of tuberculous formations. It has been asserted by Dr. Gerhard (*Lectures on the Diagnosis, Pathology, and Treatment of Diseases of the Chest*, p. 29: Philada. 1842,) that the bronchial respiration is decidedly more distinct in the right lung than in the left, especially at the summit; and he accounts for it by the greater diameter and straighter course of the tubes at the summit of the right lung, which are not lengthened and curved as on the left side by the presence of the arch of the aorta. On the other hand, M. Fournet is satisfied, that in persons presenting all the characteristics of healthy lungs, the sounds of inspiration and expiration are precisely identical in all corresponding points. In the few persons in whom he detected a slightly greater development of the expiration under the right than the left clavicle, there were motives for a doubtful opinion respecting the state of the lungs. M. Fournet thinks, from the physical condition of the two lungs, that there is no reason why they should furnish different respiratory sounds. Lastly, Dr. Stokes (*on Diseases of the Chest, Dubl.* 1837,) dwells especially on the importance of the discovery made by him, that in many persons there is a natural difference between the intensity of the murmur in either lung, and in such cases, with scarcely an exception, the murmur of the left is distinctly louder than that of the right lung. It would appear, consequently, and such is the result of our observation, that at times there is no marked difference between the two sides; that at others the intensity of the respiratory murmur is greater on the right side; and at others, again, on the left. (*Practice of Medicine*, edit. cit. i. p. 220.)]

The natural sound of respiration may be weaker or stronger; it may be absent altogether; and it may be complicated with adventitious sounds.

1. If the sound be weaker than natural in any one part, we may suspect that there is some organic alteration in that part disturbing the healthy process of pulmonary expansion; that is, that there is either slight condensation of the vesicular structure of the lungs, or partial obstruction of the bronchi leading to that part, or slight displacement of the lung from the walls of the chest. If the feebleness of the respiratory sound be general, however, we are to consider it rather as depending on some natural peculiarity of constitution than on any disease of the lungs. And we may state generally, that mere feebleness of sound, even when existing partially, is not much to be depended on as a sign of disease; when combined, however, with certain other qualities of sound, (as it commonly is,) it becomes of much more value. As we found, in respect of the degree of resonance on percussion, that there are great natural differences in different individuals; so it is with regard to the degree of the respiratory sounds. But there is no connexion between these peculiarities; as we frequently find the chest very sonorous when the respiratory sound is feeble.

It is likewise highly necessary that the student should be aware, that the degree of respiration is liable to be greatly altered by various temporary causes. In many persons, the first application of the stethoscope produces such a degree of nervousness as to render the respiration hardly audible for a few minutes; and it is only by waiting until this state has subsided that we can ascertain the real character of the respiration. In others, who are not nervous, the habitual sound of respiration is so feeble that it can hardly be perceived in the ordinary mode of exploration, even after a considerable time; and if the patency of the air-cells were not proved by some additional trials, serious mistakes in diagnosis might be the consequence. The natural suggestion, in such cases, is, to cause the patient to breathe quicker or breathe deeper; and this sort of artificial respiration, particularly the quick breathing, has often the desired effect of rendering the respiratory sounds sufficiently audible. Sometimes, however, these attempts fail; and it is necessary to have recourse to others. The most effectual are the various efforts which produce a great *want* of air in the lungs, either by expelling an unusual quantity of this fluid, or by retaining it much longer than usual. For this purpose we desire the patient to cough, to repeat a long sentence aloud, or to count as many numbers as he can without drawing breath; or we desire him to retain his breath as long as he possibly can: in any of these cases we frequently find that the inspirations immediately succeeding the forced efforts become most distinctly audible in all the points of the chest where they had been not at all or very slightly perceptible before. We must never, therefore, conclude, from a single and hurried application of the stethoscope, that the lungs are impermeable because we do not at once detect the sound of respiration.

2. It has already been remarked that the sound of respiration is naturally much louder in children than in adults. This state continues until about the twelfth year. What may be the precise cause of it is not ascertained; but that it is connected, at least with greater activity of the organ, seems to be almost proved by the fact, that whenever in adults any portion of the lungs is called upon to perform more than its wonted share in the respiratory act, that portion immediately yields a sound as loud as that of the child's lungs. Hence respiration of this kind, when observed in the adult, is termed *puerile*. In some few cases we find this loud respiration existing over the whole lungs, and then it helps to characterise certain forms of dyspnœa. But, in general, it is found only in a part of one or both lungs, or in one whole lung; and in this case it may be considered as almost a sure sign that the remainder of the organ is rendered incapable of performing its functions, from internal obstruction or external compression of its cells. Accordingly, we find this partial puerile respiration a constant concomitant of pneumonia, pleurisy, hydrothorax, and all other diseases which curtail the healthy proportions of the organ of respiration. When we observe this puerile respiration in adults without immediately discovering any physical cause for it, (as sometimes happens,) there are several morbid states of the lungs which we may suspect. It is sometimes owing to the dissemination of tubercles through lungs otherwise healthy; sometimes to partial *lobular* peripneumonies deeply seated in the lungs. Occasionally this condition of the respiration exists without any organic disease of the lungs, and can then be attributed to a nervous cause only; and at times it is caused by disease of the heart, with no other affection of the lungs except that which arises from functional disorder of the circulation in them.

3. Various morbid conditions of the organs within the chest may prevent the sound of respiration from being, in any degree, perceptible on the surface. The air may be prevented from entering the pulmonary cells of a part of the lungs, although these cells are perfectly sound, by the temporary occlusion of a large bronchial tube by tenacious secretions, as in the case of a catarrh or common cold affecting the lungs. Here the sound of respiration is wanting, because the air-cells are inactive; and here percussion will afford a good sound. While the bronchi are free for the passage of air to the air-cells, the cells may be entirely filled up by fluid or solid matters, and therefore incapable of admitting any air: this happens in inflammation of the lungs, and in some other cases; here percussion will elicit a dull sound. The lungs, although sound, may be removed from their natural situation in contact with the walls of the chest, by the interposition of matters of a solid, fluid, or gaseous character, poured into the cavity of the chest. As these matters will act in the same way, viz. by at once compressing the air-cells, and separating them from the walls of the chest, they will all equally destroy the respiratory sound; but they will furnish very different results upon application of the test of percussion. For instance, in the case of solid or liquid effusion, the sound will be quite dull; while, in the case of gaseous effusion, it will be louder than natural. The diseases that separate the lungs from the thoracic parietes are pleurisy, acute and chronic, hydrothorax, pneumothorax, &c. These, and many other cases, show the necessity of combining the use of the two methods in practice. They mutually throw a light on the indications of each other, and thus stamp a double value on our signs. By these we are enabled to discover instantly, and with the utmost facility, several most important diseases, which must otherwise often elude the skill of the best informed and most clear-sighted practitioner.

4. It was stated that the peculiar sound produced by the passage of the air in the bronchi, termed bronchial respiration, is not audible in the state of health, except occasionally over the track of the very largest branches. No doubt this sound always exists in the bronchial tubes scattered throughout the lungs; but in the state of health it is rendered imperceptible, partly on account of the bad conducting powers of the spongy texture of the lungs, and partly from its intermixture with the more general sound caused by the expansion of the air-cells. When, however, the vesicular respiration is obstructed by disease, either by the obstruction or compression of the air-cells, (as in inflammation of the lungs or pleura,) we then hear distinctly the characteristic sound of bronchial respiration, even in the tubes of middling caliber. This variety of respiration becomes, therefore, an important sign in certain diseases.

There are several varieties of the morbid bronchial respiration which deserve notice, and which the student will find described at length in the works of Laennec and Andral. In the more common variety, the sound resembles an intense degree of puerile respiration, and it might be mistaken for this if percussion over its site did not give the dull sound. At other times it resembles the noise made by blowing into a quill; and, occasionally, exactly resembles the brief, brisk puff used in blowing out a candle. There is yet another variety of morbid respiration, which, if not actually bronchial, belongs at least to the same class. This is the variety named *cavernous* by Laennec. It would appear sometimes to exist (or a sound very like it) in the case of dilated bronchi; but its general site and source is a morbid excavation in the pulmonary substance, arising almost always from dissolved tubercle. In these cases there sometimes exists the most perfect illusion of blowing into the ear through the stethoscope during expiration; while the air seems drawn from it during inspiration. This sign with its accompanying rhonchus (which will be noticed hereafter) is a most important sign in phthisis.

[The sound of expiration becomes, at times, prolonged, and, like the inspiration, may be materially altered in character. The altered expiratory sound was first urged as an important element in the diagnosis of the earliest stages of tuberculosis of the lungs by Dr. Jackson, Jr., of Boston. Prolonged expiration is, likewise, a physical sign of emphysema of the lungs; and the writer has observed it in auscultating between the scapulæ, when he has had reason to believe in the existence of dilatation of the bronchia only; and occasionally he has heard prolonged expiration apparently as a natural condition. Dr. Walshe, indeed, (*The Physical Diagnosis of Diseases of the Lungs*, Amer. edit., p. 194, Philad. 1843,) remarks, that too few observers seem to be aware, that under whatever circumstances obstruction exists to the free circulation of air in the lungs, the expiration will be prolonged;—"an obstruction, which (experience shows) never acts on the duration of the sound without affecting some of its other properties." M. Fournet states, that alterations of character of bronchial respiration always set in with the expiratory murmur, and only affect the inspiration secondarily. With this statement, Dr. Walshe says his own experience accords, in regard to chronic maladies. He believes it to be correct, also, in the very great majority of cases of acute alteration of the parenchyma of the lungs, as in pneumonia; and he thinks it probable, that in the few exceptional cases, in which a bronchial character has been detected in both murmurs simultaneously, the expiration may in reality have suffered first, "and the period of its isolated affection been so short as to prevent its being observed."]

II. *Of adventitious sounds connected with respiration.* Besides varieties of intensity, the respiration may be altered by the admixture or addition of sounds which do not exist in the state of health. These adventitious sounds may originate either in the bronchial tubes, or in morbid states of the parts exterior to the substance of the lungs.

A. The sounds of the first class are by far the most important. They are produced by the presence of some morbid secretion within the air-tubes or pulmonary cells, or by some physical alteration of the coats of these. From one variety of these sounds, audible by the naked ear, and termed, in popular language, 'the rattle in the throat,' or 'the dead rattles,' the whole have been classed by Laennec under the name of *the rattle*—in French *râle*, in Latin *rhonchus*.* There is considerable variety in these sounds; but several of them are sufficiently well characterised to be entitled to distinct appellations; and these are most valuable diagnostic signs.

The different kinds of rhonchi have their site either in the air-cells, or bronchial tubes, or in some morbid excavations formed in the substance of the lungs; and they are caused either by some substance within these, more or less fluid, and moving in contact with air, or by some other obstruction in the air-passages from external compression or alteration of their coats. A consideration of these different causes, and of the sounds resulting from them, seems to point out a very convenient mode of arranging them as follows:—1. Rhonchi having their site in the vesicles or air-cells—*vesicular rhonchi;* 2. rhonchi having their site in the bronchial tubes—*bronchial rhonchi;* 3. rhonchi having their site in morbid excavations—*cavernous rhonchi.* All the causes of these sounds may be divided into two kinds, according as they are dependent on the presence of a liquid, or on some change in the coats or caliber of the air-passages, or on obstruction from matter of a solid kind. The different kinds of rhonchi may therefore be termed either humid or dry. We shall thus have our classification as follows:—

I.—*Vesicular rhonchi.*

1. Humid vesicular rhonchus—Moist crepitous rhonchus—Râle crepitant of Laennec.
2. Dry vesicular rhonchus—Dry crepitous rhonchus—Râle crepitant sec à grosses bulles, ou craquement of Laennec.

II.—*Bronchial rhonchi.*

1. Humid bronchial rhonchus—Mucous rhonchus—Râle muqueux of Laennec.
2. Dry bronchial rhonchus. *a.* Sibilous rhonchus—Râle sibilant sec of Laennec. *b.* Sonorous rhonchus—Râle sonore sec of Laennec.

III.—*Cavernous rhonchi.*

1. Humid cavernous rhonchus — Cavernous rhonchus — Gargouillement, Râle caverneux of Laennec.
2. Dry cavernous rhonchus. This species is added more on account of uniformity, and because it is possible, than because such a variety has been described.

1. *Moist crepitous rhonchus*, or *humid vesicular rhonchus.*—The sound characteristic of this variety is compared by Laennec to the crepitation of common salt when thrown on hot iron; by Dr. Williams to the sound produced in rubbing between the finger and thumb a lock of hair, close to the ear. Other comparisons have been adduced, such as the noise of boiling butter, that occasioned

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* It is very desirable that some name might be found for this phenomenon which would prove generally acceptable to British physicians. In the translation of Laennec the nearest English synonyme, *rattle*, was used, but this word has been adopted by few. The original French term *râle* appears to be most generally employed in this country; but there are several objections to its use. In the present article we shall give a general preference to the Latin synonyme, *rhonchus*, also employed by Laennec.

by the bursting of the minute bubbles on the surface of beer or soda-water, &c. Of these the comparison of Dr. Williams comes nearest the natural sound; but that which resembles it still more closely is the crepitation of a healthy lung distended with air, when compressed in the hand. Perhaps as just a notion of it may be conveyed to the mind by imagining the quality of *roughness* superadded to the pure or smooth sound of healthy respiration. But, of course, a perfect knowledge of the sound in question can only be obtained by the actual perception of it, and the student is recommended to lose no opportunity of making himself acquainted with it, as it constitutes a sign of great practical importance. The cause of this sound is, no doubt, to be sought for in the commixture of the respired air with the secreted fluids; and whoever considers the intimate *churning* of the two fluids in a confined space like the air-cells, need have no difficulty in admitting this as the true explanation of the phenomenon. It is very probable that the mere increase of the natural humidity of the membrane, without any formal accumulation of fluid, or even that some other physical alteration of this, without increased secretion, may occasionally give rise to the crepitous rhonchus: although, as it occurs only in cases in which we know an augmented secretion to be present, there is every reason to admit the presence of fluid as one of the elements in its production.

The moist crepitous rhonchus is one of the most constant and characteristic signs of the first stage of peripneumony, appearing with its invasion, disappearing on the supervention of hepatization, and re-appearing with the partial resolution of the inflammation. At its commencement this rhonchus alters and obscures the natural respiratory sound, but does not entirely mask it: as the inflammation increases, so does the intensity of the morbid sound, until this at length entirely supersedes the other. This rhonchus, however, is not exclusively confined to pneumonia; being observed in œdema and apoplexy of the lungs, and occasionally in pulmonary catarrh and bronchitis; and, according to Dr. Stokes, in the early stage of phthisis, during the formation and development of tubercles. (Irish Transactions, vol. v. p. 326.) Indeed, if we admit that the presence of fluid, the effect of inflammation, in the air-cells, suffices for its production, we must expect that it should be occasionally present in the other diseases mentioned. But its occurrence in them is certainly very rare, while it is so constant a concomitant of the first stage of pneumonia as to justify its being considered as almost pathognomonic of it. In different states of the diseases above mentioned, we meet with intermediate varieties between the moist crepitous and the mucous rhonchus hereafter to be described.—These varieties can scarcely be characterised by words. In the case of œdema, and also in pulmonary apoplexy, the crepitous rhonchus, according to Laennec, conveys the impression as if it originated in the rupture of larger bubbles than in the case of pneumonia, in which the bubbles appear to be of extreme minuteness. In a late work on Auscultation, by Mr. Spittal, some account is given of the sounds produced by the bursting of bubbles on the surface of different fluids when agitated. He found that fluids of the density and tenacity of serum gave rise to sounds most nearly resembling those of the moist crepitous rhonchus; and M. Piorry states that the very same sound is produced in the dead body by injecting fluids into the lungs. (Du Procédé Operatoire, pp. 81, 94.

2. *Dry crepitous rhonchus*, or *dry vesicular rhonchus*.—This variety occurs only in emphysema of the lungs. Laennec says it exactly resembles the sound produced by blowing into a dried bladder, and conveys the impression of the inspired air entering and distending lungs which had been dried, and of which the cells were unequally dilated; but it is somewhat to be suspected that his knowledge of the physical change in the affected parts may have helped to suggest this similitude. It is certainly a very different sound from that last described; and it is a peculiar sound. It is observed most distinctly in the interlobular emphysema. In any case it is only heard during inspiration.

3. *The mucous rhonchus*, or *moist bronchial rhonchus*. This, as its name implies, has its site in the bronchial tubes, and not in their terminal extremities or air-cells. It is evidently produced by the passage of the air through tubes containing a fluid, and is, in fact, a mere *bubbling going* on within the bronchi. Laennec says that it presents many varieties which can be best conceived by comparing the perceptions derived from the sense of hearing, with such as we fancy might be conveyed by the sense of sight. In listening to it, our mental impressions are similar to those conveyed by what we see and hear when one blows through a pipe into soapy water. The ear seems to appreciate most distinctly the consistence of the fluid which forms the bubbles, and also their varying size. The consistence of the fluid always appears, and probably is, greater in the bronchial than in the vesicular rhonchus. The moist bronchial rhonchus belongs principally to the pulmonary catarrh and bronchitis, when accompanied with much mucous secretion, and to hæmoptysis. It is obvious, however, that it may occur in every disease of the lungs attended by considerable expectoration, as in pneumonia and phthisis. A mere variety of this rhonchus is that named *tracheal* by Laennec, the fluid occasioning the sounds being in this case accumulated chiefly in the trachea. In this variety, as the caliber of the tube is larger, and the elements of sound (if the expression may be allowed,) in greater quantity, the sound is proportionally increased—resembling occasionally, according to the expression of Laennec, the rolling of a drum at a distance, or the noise of a carriage on a paved street. In such cases the sound is commonly perceptible without the aid of the stethoscope; but sometimes when found to be very loud with this instrument, it is not heard by the bystanders. The tracheal rhonchus frequently masks the sounds of the heart and the other rhonchi when present: it may exist singly, but it is usually complicated with the common bronchial rhonchus. The bronchial rhonchus is valuable both as a diagnostic and prognostic sign. It is often the best test we possess of the severity

of bronchitis, by indicating the extent of the affection; the danger of this disease being frequently marked by the extent of membrane inflamed.

4. *The dry bronchial rhonchus.*—This includes two varieties, the *sibilant* and *sonorous* rhonchus. The former is described by Laennec as being sometimes like a prolonged whistle, shrill or base, low or loud; sometimes like the momentary and interrupted chirping of birds, or the sound emitted by the sudden separation of two portions of smooth oiled stone. The sonorous rhonchus is a dull, flat, prolonged sound; sometimes extremely loud. At one time it resembles the snoring of a person asleep, at another the bass note of a violoncello or bassoon; and, occasionally, it is so like the cooing of a pigeon that we might almost be tempted, as Laennec says, to fancy the bird below the patient's bed. These varieties of sound, and many others, frequently coexist in the same person. They are, in all probability, occasioned by the causes to which they were originally attributed by Laennec, viz. a diminution in the caliber of some portion of a bronchial tube, by external pressure, (as of an enlarged gland or hepatized spot,) by the presence of a tenacious clot of mucus within the canal, or by the local thickening of its membrane. Adopting Laennec's views, Dr. Williams explains the different resulting sounds in the following manner. He says, the form and size of the isthmus, or contracted point, will determine the nature of the sound. Of the acute whistling sound, called the sibilant rhonchus, he observes that, as we know that such a sound may be produced by air passing through a small circular aperture, it may be supposed that a contraction of this kind causes it in this case. "The sonorous rhonchus is rather produced by a flattened bronchus of considerable size. This contraction, which leaves little or no gaping aperture, throws the air passing through it into sonorous vibrations, after the manner of the reed of the hautboy, or the lips in blowing a horn; or, perhaps, the production of this sound is still more completely represented in the manner in which a celebrated ventriloquist imitates, with his lips, the buzzing of a fly." In another variety of the sonorous rhonchus, noticed by Laennec, and which Dr. Williams well characterises as resembling "the sound of a click-wheel," the sound is probably produced, as Dr. Williams says, "by a portion of very viscid mucus attached to the interior of a bronchial tube, which, yielding with a jerking resistance to the air forcing its passage, thereby causes a ticking sound."—(Rational Exposition, &c. p. 32.)

5. *The cavernous rhonchus.*—The rhonchi hitherto mentioned, although depending on a morbid condition of the part in which they originate, still have their site in cavities naturally existing in the state of health; that now to be considered is in every respect morbid—in its site as well as its cause. It may exist in all cases where there is a morbid excavation in the lungs containing a fluid, and communicating with the bronchi; as in circumscribed abscess, and in local gangrene of the lungs, and in the latter stages of tubercle. The last named is by far the most usual source of this sign, insomuch that we doubt if it arises once in a hundred times from any other cause. It is characterised by a strongly marked mucous rhonchus or guggling, confined to a small spot, instead of being diffused over a considerable portion of the lung, as is usually the case with the common humid bronchial rhonchus. It is particularly heard upon the patient taking a deep inspiration, or after coughing; and if, under such circumstances, it is very strongly marked, continues fixed in the same point, and is not heard in any other, it is one of the surest signs of tuberculous excavation, even without pectoriloquy and the cavernous respiration, which will generally be perceptible in the same point. Andral, a high authority, considers this circumscribed bubbling rhonchus, when well marked, as the very surest sign of a tuberculous cavity.

In reference to all these louder rhonchi, it is well to recollect that they are often audible through a pleuritic effusion: we must not therefore conclude from their mere presence that the lungs are in contact with the chest.

B. The second class of morbid sounds which complicate healthy respiration comprehends fewer varieties, and these of less importance than the last.

1. *Metallic tinkling*, or *metallic resonance.*—This name, literally translated from the original epithet bestowed on the sound by Laennec, (*tintement metallique*,) applies to one of the most singular, though not one of the most important results obtained in the exploration of thoracic diseases by means of auscultation. This sound is observed only in cases where there exists within the chest a large preternatural cavity containing air. By far the most common occasion of it is the presence of air in the sac of the pleura in the disease termed pneumothorax. It however is observed, although very rarely, in other cases, particularly in very large tuberculous excavations. As in the great majority of cases of pneumothorax there coexists with the gas a liquid effusion in the pleura, and likewise a communication between the pleural cavity and the bronchi, Laennec, the discoverer of the phenomenon, was led to consider its production as almost exclusively confined to this complex morbid state. It has, however, been since proved that neither the existence of liquid effusion, nor the communication with the bronchi, is necessary to its production. The sound is most commonly excited by the act of respiration, or speaking, or coughing; but it also arises independently of any of these. Coughing produces it more frequently and more certainly than any of the other respiratory acts. There are two varieties of this phenomenon, the one known by the general name of *metallic tinkling;* the other termed by Laennec *amphoric resonance*, or *buzzing*, (bourdonnement amphorique.)

The first of these varieties resembles the sound emitted by a cup of metal or glass when gently struck with a pin, or into which a very minute pebble or grain of sand is thrown; or it is like the sound of a brass wire vibrating under a sharp but gentle stroke of the finger. The *amphoric resonance* is of a character less definite, but not less distinct. It is like the sound produced by blowing quickly and forcibly into a bottle or other large empty vessel having a small aperture. It is also called *metallic resonance.*

Both these sounds are most frequently occasioned by the impulse communicated to the gaseous fluid in the sac of the pleura, by a blast of air from a fistulous opening in the lungs; the difference of sound depending, most probably, on the nature of the opening. They also originate when there exists no such opening, the impulse being conveyed from the air within the bronchi through a stratum of condensed pulmonary substance, or other matter capable of communicating it, to the air in the cavity, the vibrations of which are the immediate cause of the peculiar sounds. The first of the two sounds, the metallic tinkling, is likewise found to arise without any external impulse, by the mere falling of a drop of fluid from the superior part of the cavity into the fluid collected in the under part of it. The value of these sounds as signs of disease will be noticed in the article PNEUMOTHORAX, to which the reader is referred.

2. *Sound of friction.* This sound, termed by Laennec *bruit de frottement ascendant et descendant*, is rather connected with the thoracic movements which effect respiration than with respiration itself. It was first observed by Dr. Honoré, but has been since more completely investigated by M. Reynaud, one of Laennec's pupils. It is an obscure dull sound, quite distinct from the respiratory murmur, but exactly synchronous with the motions of inspiration and expiration. This sound is precisely such as we might conceive would be produced by the friction of a body, somewhat rough, against the inner side of the walls of the chest, rising and descending regularly with the respiratory movements. It is in general proportioned to the extent of these, being loudest during deep inspirations, and in some cases only audible then. This sound is found to occur only when there exists considerable roughness or inequality on the surface of the lungs or costal pleura. Laennec considered this sound as a sign of interlobular emphysema; and it seems probable that it is so in certain cases. It has, however, been found more certainly in pleurisy, when the membrane was rendered rough by partial effusions of a solid albuminous kind, with little or no accompanying serum. In this case it is well established as a sign; and it may be regarded as of favourable omen, inasmuch as it denotes a moderate effusion, and that the lung is sufficiently dilated to come in contact with the walls of the chest.[*]

Auscultation of the Voice.—If we apply the hand to the chest while a healthy person is speaking, we are almost always sensible of a slight vibration, at least, evidently produced by the sound of the voice; and a vibratory sensation, rather than a formal sound, is communicated, under similar circumstances, by the stethoscope, to the ear.

[Great discrepancy exists amongst observers, in regard to the true signification of this *vocal fremitus* and its modifications, as the following table, by Dr. Walshe, clearly exhibits. (*The Physical Diagnoses of Diseases of the Lungs,* Amer. edit. p. 164, Philad. 1843.)

NATURAL VOCAL FREMITUS.

	Increased.	Diminished.	Unaffected.
LAENNEC. STOKES.		In consolidation and in effusion.	
REYNAUD. WILLIAMS. HOURMANN.	In consolidation.	In effusion.	
GRISOLLE.			In consolidation, from pneumonia at least.
FOURNET.	Impossible in any case.	In all changes of density, whether of increase or decrease.	

Dr. Walshe is, we think, correct in entertaining not the slightest doubt, that M. Fournet is in error in the principle which he affirms in regard to the non-increase of vibration. Like Dr. Walshe, we have found it manifestly augmented in cases of tuberculous consolidation of the top of the lung, as well as in pure hepatization. Dr. Walshe adds, that he cannot help feeling, that there is something of importance yet to be discovered respecting this sign, which may furnish a ready clue to the contradictions in the statements of writers on the subject.]

In many cases, indeed, particularly in persons who have large chests and a base voice, we recognise a distinct vocal resonance over the whole chest. And in every case, when we apply the stethoscope over the origin of the larger bronchial tubes, as between the scapulæ, we hear the voice much more distinctly; sometimes even as loud as the voice from the speaker's mouth. The words are also sometimes distinguishable; but they appear as if playing round the extremity of the instrument, and not as entering, much less traversing, its tube. When, however, we place the stethoscope on the larynx or trachea, on the fore-part of the throat, while the individual is speaking, we then hear the whole of the words passing directly through the instrument into the ear, exactly as if the mouth, in place of the larynx, were applied to the end of the instrument; and the voice so heard is much louder than the natural voice heard by the other ear. The cause of these sounds (denominated by Laennec, from their site, *bronchophony* and *laryngophony*) depends, no doubt, on the fact, that, in the act of speaking, the vocal vibrations always extend inwards along the air-tubes, as well as outwards through the mouth and beyond it. The stethoscope merely supplies a conductor for their conveyance to the ear. The vocal sounds are loud and distinct in the trachea, because there is sufficient space there for the aerial vibrations that constitute the sound; because the more solid walls of this part are well calculated to propagate it; and because it lies near the surface. The gradual loss of all these conditions favourable for the generation and propagation of sound, as the trachea descends into the chest and there becomes transformed into small tubes traversing the spongy texture of the lungs, sufficiently explains the imperfection of the vocal resonance in the larger bronchi, and its total absence in the smaller branches.

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[*] De l'Auscult. Méd. 3me. edit. t. i. p. 120. Ibid. p. 335, *note.* Ibid. tom. ii. p. 319, *note.*—*Reynaud*, Journ. Hebdom. No. 65, p. 576.—*Andral*, Clin. Méd. 2me. edit. t. ii. p. 613.

In certain states of disease, however, both the bronchial and laryngeal sounds become developed in places where they do not naturally exist; and as it has been ascertained that the causes of this morbid development of the voice are certain fixed physical changes of structure, these *voices from the chest* become important signs of disease.

[In the space, corresponding posteriorly to the origin of the right bronchium, the voice resounds more strongly than in the corresponding part of the left side. According to Sir James Clark, the natural resonance is more intense under the right than the left clavicle, and with this our observation accords. Dr. Stokes, indeed, considers that it is more intense over the whole of the right side. (*On the Diseases of the Chest*, p. 297, Dubl. 1837.)]

The sounds produced within the chest by the voice, that are available as signs of disease, are of three kinds, and may be arranged as follows: —1. Simple bronchophony, or bronchophony with the healthy character, only developed in places where it does not exist in health; this, for the sake of brevity, we shall term *bronchophony*. 2. Complex bronchophony, or bronchophony with the healthy sound modified in a peculiar manner, and developed in places where it does not exist in health: this is termed *ægophony*. 3. Perfect laryngophony developed in the chest: this is termed *pectoriloquy*.

I. *Bronchophony*. The same causes which render bronchial respiration audible in disease, in places where it is not perceptible in the state of health, render bronchophony equally audible, and for the same reason, viz. by rendering the pulmonary tissue a better conductor of sound. Whenever, therefore, we have the substance of the lungs considerably condensed in the vicinity of bronchial tubes of moderate size, without obliteration or great compression of their caliber, we may expect to have bronchophony developed. The morbid states in which it is found are chiefly hepatization and induration from the deposition of solid tubercular matter. It may also originate in other kinds of condensation of the pulmonary tissue, such as pulmonary apoplexy, melanosis, &c., and also in certain cases of dilatation of the bronchi.

[This last fact shows, that consolidation is not necessary to induce increased resonance of the voice. Dr. Skoda, indeed, maintains that bronchophony is not always a persistent phenomenon in hepatization; that at one time it is very strong; at another equally weak; and the cause of the occasional disappearance of resonance he conceives to be—the obstruction of the tubes of the hepatized part by fluid matters; as the resonance readily reappears when the patient makes a deep respiration or coughs. Dr. Skoda refers bronchophony to consonance or reciprocation — a well-known acoustic phenomenon; and the fact, above-mentioned, of the occasional disappearance of the resonance when the lung is unquestionably hepatized, seems to corroborate this view. (For the auscultatory views of Skoda, see *Edinb. Med. and Surg. Journal*, for July 1841; or *American Med. Intelligencer*, for Aug. 1841.)]

The general characters of this morbid, or *accidental* bronchophony, as it is termed by Laennec, are as above described; some further particulars of the sound will be noticed in the subsequent paragraphs, when we come to contrast some other sounds with this. Bronchophony is most valuable as a sign in peripneumony and in phthisis. In the former it is most evident when the inflammation exists near the roots of the lungs, and in the upper lobes where the bronchi are largest: it is much less frequent and more obscure in the lower lobes. When the hepatization has its site very near the surface of the lungs, and where the bronchi are particularly large, it frequently approximates to laryngophony. The bronchial respiration is always present with bronchophony; and frequently also the common vesicular respiration, except in cases where the hepatization is very extensive. Bronchophony is a less important sign in phthisis, but when existing, as it frequently does, beneath the clavicles, particularly if on one side only, and other symptoms of this disease are present, it tends strongly to confirm the general diagnostic.

II. *Ægophony.*—If in any of the cases in which the preceding sign exists, a thin layer of fluid is superadded, between the surface of the lungs and costal pleura, the natural simple sound of broncophony is so much and so peculiarly altered as to merit and obtain a distinct appellation, and be considered as a distinct sign. This modification of bronchophony has been termed ægophony by Laennec, (from *αἶξ, αἰγὸς, capra*), because it possesses somewhat of the broken, bleating cry of the goat, and approaches the usual key of this animal's voice. It is a kind of silvery voice, of a sharper and shriller tone than that of the patient, seeming to float and vibrate on the surface of the lungs, and sounding more like the echo of the patient's voice than the voice itself. Different varieties of this phenomenon resemble more or less closely various sounds with which all are more or less familiar, e. g. the voice through a speaking-trumpet, or cleft reed; that of a person speaking with something between his lips and teeth; the squeaking of Punch, &c. The last-mentioned comparison is certainly sometimes extremely exact, particularly in persons who have a base voice. The sort of bleating so characteristic of ægophony, seems, in most cases, connected with the articulation of the words; sometimes it seems unconnected with this, so that we can hear at the same time, yet separately, the simple sound of the natural voice, and the bleating sound of ægophony. In order to hear the sound well, the instrument must be applied with considerable force to the patient's chest, but the ear must not be pressed against the other end with more than the usual force. Ægophony only exists in pleurisy or hydrothorax, when the quantity of effused fluid is just sufficient to form a thin layer between the surface of the lung and costal pleura. The compression produced by the external fluid seems to produce the requisite degree of condensation of the pulmonary substance, to enable it to conduct the bronchial resonance, and the passage of this through the stratum of mobile fluid on the surface, seems to occasion the peculiar modification of the sound above described. Dr. Williams says, that in addition to the preceding requisites, there must likewise exist a certain proportion between the mass of liquid and the pitch and strength of the vocal sounds, otherwise the fluid will not be thrown into vibration. This, he says, is proved by the fact that certain tones of the same voice are ægophonic and others not. (Rational Exposition, p. 107.) Ægophony is always found to extend over a certain portion of one side of the chest, being most commonly perceptible, at the same time, in the intrascapular region, round the lower angle of the scapula, and in a zone, from one to three fingers broad, following the line of the ribs, from the middle of this bone to the nipple. Of its importance as a sign in pleurisy, we need only quote the statement of Laennec, who says that he had observed it in almost every case of pleurisy which had come under his care for the last five years before the publication of his second edition. The same author adds, that he has detected ægophony where there did not exist above three or four ounces of fluid within the chest. Ægophony only exists, as already said, when the effused fluid is in moderate quantity; it therefore is found to disappear when the pleuritic effusion surpasses this amount, and it again returns when absorption has reduced it to the proper quantity. The original opinion of Laennec as to the cause of this singular phenomenon, seems to be generally admitted as just. He says, "I consider ægophony to be owing to the natural resonance of the voice in the bronchial tubes, rendered more distinct by the compression of the pulmonary texture, and modified by its transmission through a thin layer of fluid in a state of vibration." Dr. Williams says, that "the tremulous or subsultory sound of the ægophonic voice is produced by the successive undulations of the liquid, the result of an irregular transmission of the sonorous vibrations." Ægophony and bronchophony frequently exist together, as might be naturally expected; and, although each is sufficiently well marked to be recognised by its distinctive characters, like all similar phenomena they run into each other, and it is not seldom impossible to pronounce with certainty whether the sound is the one or the other.

III. *Pectoriloquy.* The most singular, as it was one of the first, of the results of Laennec's exploration of the voice, was the discovery of perfect laryngophony in different parts of the chest as the consequence of disease. The condition of parts necessary to produce this curious phenomenon (termed by the discoverer *pectoriloquy*, or chest-speaking, from *pectus* and *loquor*,) is the existence of a preternatural cavity communicating with the bronchi, amid the spongy texture of the lungs; the existence, in short, of a sort of artificial larynx, or space sufficient for the full development of the vocal vibrations, which always exist, in a modified degree, in the larger air-tubes. When the stethoscope is placed on the chest directly over a cavity of this kind, the articulate and perfect voice of the individual seems to reach the ear through the tube, as distinctly as when this is placed on the larynx; and the voice thus heard is often louder and more distinct than the natural voice that issues from the mouth. Cavities of this kind are occasionally produced by more than one disease of the lungs; but in a vast majority of cases they are the result of the suppuration or softening of tubercles. The other cases in which this phenomenon may be perceived are, according to Laennec, the following: cavities produced by the dissolution of a gangrenous eschar, by an abscess the consequence of peripneumony, and by the bursting of a cyst into the bronchi. When pectoriloquy is well marked, there is a perfect identity between it and the sound of the voice heard through the stethoscope when resting on the larynx: and as this means of comparison is always at hand, a reference to it will be more serviceable than any description of the sound however elaborate. It is to this that the student must always recur as a test of the fidelity of his judgments in exploring the chest for pectoriloquy. It is, however, well that he should be made early aware that pectoriloquy so perfect as this is by no means of universal occurrence in phthisis, even in cases in which we have other proof of the existence of tuberculous cavities. Indeed, we are disposed to believe with Andral that perfect pectoriloquy is by no means extremely common, and that bronchophony is frequently mistaken for it. Laennec was well aware that pectoriloquy was often very different in different cases, according to the size, shape, and nature of the walls of the cavity, its degree of emptiness or fulness, its mode of communicating with the bronchi, its particular site in the lungs, &c. &c.; and he was careful in describing several varieties of it. The principal of these he termed perfect, imperfect, and doubtful pectoriloquy. He considers it *perfect* only when the transmission of the voice through the instrument is complete, and when it can be still further discriminated from bronchophony, by being confined to one spot, and by the corresponding circumscription of the cavernous respiration and cavernous rhonchus, which commonly accompany it. It is *imperfect* when any one of these characteristics is wanting, and especially if the transmission of the voice is not evident. It is *doubtful* when the sound of the voice is very feeble, and when it can be distinguished from bronchophony only by the aid of other signs derived from the consideration of its site, the general symptoms, and the progress of the disease.

The circumstances which concur to render pectoriloquy perfect are, the complete emptiness of the cavity, the increased density of the pulmonary substance which constitutes its walls, its free communication with one or more bronchial tubes of a certain diameter, and its proximity to the walls of the chest. The absence of more or fewer of these conditions will tend to render pectoriloquy more or less imperfect; but it may be very imperfect and yet not at all doubtful as a sign of the existence of a cavity. In all cases of imperfect pectoriloquy, the discovery of the same sound on both sides must always render it doubtful. It is however to be recollected that the most perfect pectoriloquy may become in an instant very imperfect, or may entirely disappear, owing to the changes that may take place in the contents of the excavation, or of the bronchi leading to it. Excavations of a moderate size, and of a regular rounded shape, give the most perfect pectoriloquy. If the caverns are very large or irregularly shaped, the sound of the voice is indistinct, and this is also the case if they are very small. The more empty the cavities are, the pectoriloquy is the more evident. It is also more distinct according as the voice of the individual is more sharp; and as women and children have this kind of voice most commonly, it is well remarked by Laennec that we must be particularly on our guard, in their case, not to confound natural bronchophony with pectoriloquy. The deeper the voice is, the resonance within the chest is the stronger; and it often happens, in such cases, that in place of penetrating the tube of the instrument, it seems to sound at its extremity much louder than the natural voice; as if the patient were speaking through a speaking-trumpet quite close to us, and not through the stethoscope into the ear, as in common pectoriloquy. For further details respecting this sign, we must refer to the article PHTHISIS, in which disease it constitutes a most important sign. We must, however, be permitted to observe that too much stress has been laid upon the value of pectoriloquy as a pathognomonic sign of phthisis. Where it clearly and unequivocally exists, it is unquestionably pathognomonic; and in many doubtful cases it is of inestimable value in determining the nature of the disease. It cannot, however, be denied that it is only in rare cases that its discovery influences either our diagnosis, prognosis, or practice. The rational signs of phthisis serve, in the great majority of cases, sufficiently to characterise it; and when these are corroborated and crowned by the addition of pectoriloquy, the case is in almost every instance already beyond the power of remedy. And yet we are far from wishing to represent this sign as of little value even in phthisis. It is by it alone, or by it and the other physical signs produced in caverns by the respiration and cough, that we can be certain of the existence of tuberculous cavities at all, or of their situation, number, or extent; and every pathologist knows how much the prognosis at least, if not the treatment, may be improved by this knowledge. Besides, there are several cases, of not very rare occurrence, in which such knowledge is of infinite value both as to prognosis and treatment. One of these is when all the rational symptoms of phthisis are produced by chronic bronchitis; and another where one or two tuberculous excavations exist in an otherwise sound lung, and without producing any of the rational or constitutional symptoms of phthisis. It is unnecessary to say of what value to the practitioner will be the assurance of the non-existence of pectoriloquy in the one of these cases and its existence in the other. In the latter case, *the voice from the chest* may announce the speedy approach of suffering, and sorrow, and death, perhaps amid all the outward semblances of health; and in the former, its silence to all our questioning may not merely bid hope take the place of despair in the breast of friends, but may awaken the physician from the torpor of inactivity, and induce him to adopt such measures as may convert this hope into certainty.

[It has been proposed to associate auscultation with percussion;—in other words, to listen with the common stethoscope, or with one modified for the purpose, whilst a part is struck in the ordinary method of mediate percussion; and value has been assigned to *auscultatory percussion*, *acouophonia*, or *cophonia*, thus practised; but it has not been much used, and is affirmed by M. Fournet (*Recherches Cliniques sur l'Auscultation*, &c. Paris, 1839,) to be deceptive,—the perceived sound bearing no precise relation to the condensation or rarefaction of the adjacent parts. Hence, it has been denounced, but in too strong language, perhaps, by Dr. Walshe, as "obviously worse than useless." (*The Physical Diagnosis of Diseases of the Lungs;* Amer. edit. p. 154: Philad. 1843.)

The term *autophonia* has been given, by M. Hourmann, to an auscultatory process, of which M. Taupin considers himself the inventor. It consists in noting the character of the observer's own voice, whilst he speaks with his head placed close to the patient's chest. The voice, it is alleged, will be modified by the condition of the subjacent organs. M. Hourmann considers it a really useful sign in the examination of infantile diseases. (Walshe, *Op. cit.*)]

Auscultation of the Heart.

If we apply the ear, with or without the stethoscope, to the cardiac region of a person in health, we perceive, most distinctly, a series of sounds of a very marked and peculiar kind, subdivided into uniform parts by a brief interval of silence, after every second sound. Two sounds follow each other instantly, or within so short a space that the ear separates them rather by difference in their quality than from the intervention of any notable cessation of sound: then ensues a brief but well-marked pause, which is again succeeded by the first of the twin sounds. This series of sounds may be perfectly well represented, as to rhythm, by musical notation. The relative duration of the sounds and pause is represented by Laennec to be nearly as follows: the whole being divided into four parts, two of these are occupied by the first sound, and one by the second sound and the pause respectively. The two sounds differ in kind as well as in duration. The first is nearly double the length of the second, of a graver and more subdued tone, rather louder at its commencement than at its termination, as if it was about to die away when suddenly interrupted by the second. The second is brief, smart, and clear, like a gentle tap with the pulp of the finger on a solid table, or, according to Laennec's comparisons, like the sharp sound produced by the falling back of a valve, the cracking of a whip, or the lapping of a dog. [To convey a notion of these sounds, Dr. C. J. B. Williams employs the compound word *lubb-dup*, the first word of the compound expressing the protracted first sound; the latter the short second sound.] Exactly synchronous with the first sound, there is perceptible, in most cases, a well-marked impulse or shock, communicated evidently by a body in motion within, to the walls of the chest. Every one acquainted with anatomy and physiology will at once conclude that the sounds and impulse just described are produced by the motions of the heart; and this conclusion will be justified and confirmed by an examination of the pulse in the extremities. It will be found, in all healthy subjects, that there is an invariable connexion between the sounds and the pulse, every stroke of the latter corresponding very accurately with every repetition of the twin sounds. As, under every variation of circumstances as to loudness, frequency, &c., the same exact relation is perceived, it cannot be doubted that there exists an essential physical connexion between the causes of the sounds and the pulse.

For a long time after the discovery of mediate auscultation, no doubt was entertained that the exposition of the motions and sounds of the heart, given by Laennec, was the true one. He asserted that the first of the two sounds accompanied and was caused by the contraction of the ventricles; the second by the contraction of the auricles; and that the pause intervened between the auricular and the ventricular sounds. As a necessary consequence of this doctrine, he taught that in the natural rhythm of the heart, the ventricular systole comes first; is followed immediately by the auricular systole; and this, in its turn, by the interval of repose.

The accuracy of these statements of Laennec was first called in question by Mr. Turner, in a paper published in the third vol. of the Edin. Med. and Chir. Transactions; and the subject has been since more completely illustrated by the observations and experiments of Drs. Corrigan, Stokes, and Hope.* The experiments of the last-named physician made on large animals (asses) are particularly deserving our attention and confidence. They are of such a kind, indeed, as, in our opinion, to set the question at rest; the results having been repeatedly witnessed by many most competent judges, and being in complete accordance with the pathological phenomena observed in the human subject, during life and in the dead body. Dr. Hope has recently repeated his experiments, with results precisely similar to those formerly obtained, and has been kind enough to favour us with a sketch of the natural movements of the heart and the relation of the sounds to them. This we shall here give almost in Dr. Hope's own words, being happy to avail ourselves of an authority so deservedly high, founded as it is on the most extensive observation particularly devoted to the subject.

Rhythm of the heart.—The first motion of the heart which interrupts the interval of repose, is the auricular systole. It is a very slight and brief contractile movement, more considerable in the auricular appendix than elsewhere, and propagated with a rapid vermicular motion towards the ventricle, in the systole of which it terminates rather by continuity of action than by the succession of a new movement. The ventricular systole commences suddenly, and is accompanied with a considerable diminution of the volume of the organ. Synchronous with the systole are the first sound, the impulse of the apex against the ribs, and the pulse in vessels near the heart: in the radials the pulse follows at a barely appreciable interval. The systole of the ventricles is followed by their diastole, during which they return, by an instantaneous expansive movement sensible to the touch and sight, to the same state (with respect to size, shape, position, &c.) as during the previous interval of repose. This movement, or diastole, is accompanied by the second sound, by an influx of blood from the auricle, by a retractile motion of this cavity most observable at its sinus, and by a retrocession of the apex of the heart from the walls of the chest. Next succeeds the interval of repose, during which the ventricles remain at rest, in a state of fulness, though not of distension, through the whole period intervening between the second and the first sounds; but the auricle remains at rest during the first portion only of that period, the remainder being occupied by its next contraction, with which recommences the series of actions described.

The duration of the several parts of a beat is the same as described by Laennec; namely,

1. The ventricular systole occupies half the time, or thereabouts, of a whole beat.

2. The ventricular diastole occupies one-fourth, or at most one-third.

3. The interval of ventricular repose occupies one-fourth, or rather less, during the latter half of which the auricular systole takes place.

Causes of the motions.—The auricles, which are always in a state of fulness, arrive, during the first half of the period of ventricular repose, at the state of distension, by which they are stimulated to contract. The object of the contraction at this moment is to propel a small additional quantity of blood into the ventricles, for the purpose of bringing them from the state of fulness to that of distension; an object which could not be accomplished without a contraction, as the blood could not otherwise force its way into the ventricles against the resistance offered by their elasticity. These cavities, then, being brought to the state of distension, are by this stimulated to contract: they expel a greater or less proportion of their contents: in small animals, frogs for instance, they expel the whole; which is proved by the ventricle becoming pale. In large animals they do not *appear* to expel the whole, but the fact does not admit of demonstration. During the act of expulsion, the apex is tilted up, in consequence of the retraction of the ventricles towards the base and upon the auricles, which, in a state of extreme distension, are placed like a fulcrum beneath them. The diastole appears to be occasioned by several concurrent causes, viz. 1. That power of the muscle by which it reverts from the state of contraction to that of relaxation, and in virtue of which it exercises a degree of motion. It may be called *elasticity* until its nature is more positively determined. 2. The distension of the auricles, which is greater at this moment than at any other, as they have been filling during a longer period; namely, that of the ventricular contraction, or half a whole beat. 3. The weight of the ventricles collapsing on the distended auricles underneath them. 4. The width of the auriculo-ventricular orifice, which allows the blood to shoot in instantaneously and with great facility. It is obvious that, as so many powerful causes conspire to promote the influx of the blood, an auricular contraction for this purpose, as imagined by Laennec, would be superfluous. The escape of blood from the auricles during the diastole, causes the slight retraction observable in them at the same moment. The expelled blood being instantly replaced from the venæ cavæ, distension of the auricles recommences, and the same series of actions is renewed.

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* See the communications of these gentlemen in the Lancet, Edinb. Journal and Med. Gazette.

Causes of the sounds.—The ventricular systole is the cause of the first sound, by the impulse which it communicates to the blood within it, thereby exciting sonorous vibrations of that fluid. If the sound of the muscular contraction contributes at all to the first sound, it can be only in a very slight degree. The ventricular diastole is the cause of the second sound, by the re-action of the walls on the blood, and the consequent production of sonorous vibrations, when its course is abruptly arrested by the completion of the diastole. Hence this sound is loud, brief, and clear. The auricles are not concerned in the production of the *two* sounds, as they take place when these cavities are motionless; nor do they appear to be productive of any sound, as no *third* sound is audible.

[The causes of the two sounds can scarcely be regarded as settled. From accurate experiments made by Drs. Pennock and Moore, of Philadelphia, (*Medical Examiner*, Nov. 2, 1839; and *American Medical Intelligencer*, Dec. 16, 1839; or Pennock's edition of Hope *On Diseases of the Heart*, Philad. 1842,) they suggest, that the first sound may be a combination of that caused by the contraction of the auricles, the flapping of the auriculo-ventricular valves, the rush of blood from the ventricles, and the sound of muscular contraction. The second sound they refer exclusively to the closure of the semilunar valves by the refluent blood from the aorta and pulmonary artery. The main results of the experiments of these gentlemen accord greatly with what the writer has entertained and taught on the subject. Still, the matter is open for fresh investigation; especially as M. Cruveilhier, from a case of ectopia cordis, carefully examined by him, inferred that the greatest intensity of the first sound is in the same situation as the greatest intensity of the second—that is, at the origin of the larger arteries; or, in other words, that both sounds are seated in the semilunar valves. (*Gazette Médicale de Paris;* Août, 1841, p. 535.) The different views on the sounds of the heart, entertained by different observers, are given elsewhere. (The writer's *Human Physiology*, 5th edit. ii. 119, Philad. 1844; and *Practice of Medicine*, 2d edit. ii. 460, Philad. 1844.)]

We now proceed to examine more minutely the phenomena produced by the actions of the heart, in health and disease, with the view to deduce therefrom such diagnostic signs as they are capable of affording. It is hardly necessary to premise that the auscultatory diagnostics of cardiac diseases are founded precisely on the same principles as those which apply to diseases of the lungs. We have certain natural sounds and movements, depending on the physical structure and natural action of the parts, and therefore of constant occurrence in the state of health. These sounds and movements are changed from their normal character by disease, in a certain determinate manner, in accordance with the known laws of physics. If we are acquainted with the movements and sounds of health, and with their various relations, we can have no difficulty in detecting their morbid deviations. And as these deviations depend on fixed physical changes of structure, just as the normal sounds depend on the normal structure, the study of the former sounds will enable us to ascertain the existence of the morbid causes, as in the other case the sounds of health indicated the presence of the normal structure.

In strictness of language, auscultation can only take cognizance of *the sounds* which accompany the motions of the heart. As, however, these sounds are intimately connected with the shock or impulse communicated to the side, and as this important sign is appreciated by the same organ (the ear), though not by the same sense, it has been customary to consider it along with the phenomena of sound and rhythm, which are strictly referable to the sense of hearing. As this arrangement is extremely convenient, we shall adopt it in the present article; and shall, indeed, commence with the consideration of the phenomenon which, in a philosophical arrangement, could not be admitted at all.

I. *Impulse.*—This, as we have already said, is, in the state of health, always coincident with the first sound. It is not, however, exclusively confined to this period of time in the state of disease. The impulse may vary from the ordinary standard in different individuals in health, and in the same individual in disease: 1. in the period of its occurrence, or its relation to the sounds; 2. in its individual character, particularly in its degree or intensity; 3. in its sphere, or the extent of chest over which it is perceptible.

1. Although the impulse is usually synchronous with the first sound, and with this only, it occasionally accompanies the second sound also. This, however, is of rare occurrence, and is only met with in a particular form of disease. It has also a very different character from the normal impulse which accompanies the first sound. It is perceived, according to Laennec, to have its origin much deeper within the chest than the other stroke, and, in giving it, the heart seems to be receding from the ear. Most commonly it consists merely of a sort of trembling felt deep within the mediastinum; and it is always very slight in degree when compared with the normal impulse. Dr. Hope terms this second impulse *the back stroke*, and considers it as in a great measure confined to cases of hypertrophy with dilatation; or, rather, that it is observed more particularly in this disease when existing in a great degree.

2. There is great difference among individuals in perfect health respecting the degree of impulse. In some no impulse can be detected either by the hand or stethoscope; in others it is imperceptible by the hand, and very perceptible by the stethoscope; and in some rare instances it appears on the application of the hand to be very great, at the same time that the instrument conveys only a slight impulse. These varieties depend on fixed physical causes, although they may not be readily explicable in every case. In lean subjects all movements as well as sounds are more perceptible from the greater susceptibility of the chests of such persons to vibrate, and their greater conducting power. In nervous flurry, the heart acts tumultuously and not powerfully, producing rather

a general commotion than impulse; hence the effect is more distinct to the hand than to the stethoscope. In general, the impulse consists simply of the sensation of a slight blow or shock, communicated to the spot on which the hand or instrument rests, sometimes sufficiently strong to produce a perceptible elevation of the part, at other times only having sufficient power to occasion a sort of vibration without upward movement. Sometimes the body that gives the shock appears to be of large extent, sometimes quite small. The blows are sometimes quite distinct and abruptly defined; at other times they seem to run into each other. The causes of these differences are also well known. The brief, sharp impulse corresponds with a sudden abrupt blow, unaccompanied by any heaving of the heart, and indicates an organ with thin parietes. The prolonged impulse, with an extensive heaving movement, is the sign of thick walls, whether natural or from disease. In all cases the degree of impulse varies greatly according to the state of repose of the patient. Every kind of bodily exercise or mental excitement; in other words, every thing which stimulates the muscular action of the heart, or hurries the circulation, augments the impulse. When causes of this kind act powerfully, they produce what may be considered as a factitious or temporary palpitation; and in such cases the impulse of a healthy heart is sometimes very great, being sufficient to elevate the ear as by a sudden blow. It is for this reason an invariable rule to depend only on such stethoscopic explorations of the heart as are made during a state of quietude both of body and mind. In this state, in healthy individuals having hearts well proportioned, the impulse is in general not very perceptible, and in a considerable proportion of cases it is quite imperceptible. When the respiration is frequent and laborious, we must be careful not to mistake the rise of the thoracic parietes, during inspiration, for the impulse of the heart.

It may be stated as a general rule, that, *cæteris paribus*, the degree of impulse is in proportion to the thickness of the walls of the ventricles, the impulse being greater, the thicker the walls. If, then, we find a degree of impulse beyond the ordinary standard, habitually present even during repose, we may be almost certain that there exists hypertrophy of one or both ventricles, more particularly if the pulse continues of moderate frequency. Increased impulse, as already stated, is a constant result of increased action of the heart, without any addition to its muscular substance. But in such cases the pulse (that is, the contraction of the heart) is always preternaturally frequent. Preternatural intensity of impulse with natural frequency of action—or with very slightly increased frequency—can hardly arise but from hypertrophy of the heart.

Many causes, particularly those of a depressing kind, greatly diminish the degree of impulse, and sometimes entirely destroy it, when previously existing in a preternatural degree. Of this kind are bloodletting, diarrhœa, whether natural or artificial, great abstinence, &c.; in such and similar states of the system, we must, therefore, be cautious in pronouncing against the existence of hypertrophy merely from the absence of impulse. Impulse also disappears, even when there exists considerable hypertrophy, upon the supervention of great dyspnœa, as in pleurisy, pneumonia, the asthmatic paroxysm, and likewise in the congested state of the lungs and heart which so generally precedes death.

In all these cases perhaps, certainly in the greater number, the disapearance or diminution of the impulse depends on the natural actions of the heart being impeded by the morbid accumulation of blood in its cavities. Cases certainly occur, also, in which, from some unknown causes, an hypertrophous heart does not give any preternatural impulse, as well as others in which an habitually great impulse accompanies a thin organ. But these are merely exceptions—rare exceptions—to a general rule, which is unquestionably as stated above. The rationale of increased impulse from hypertrophy of the heart is sufficiently clear. In the first place, the organ is larger, and its actions will necessarily bring it more closely in contact with the chest; secondly, having a greater number of contractile fibres, its contractions must be more energetic; and, thirdly, the very condition of a hypertrophied muscle almost involves the fact of augmented irritability and activity.

It is well remarked by Andral, that, even if we were unable to account for the anomalies now referred to, both of increased and diminished impulse, we have no reason to doubt the truth of the general proposition. It is not to be wondered at, if, in a machine so complicated, and subject to such diversity of influences, as the human body, we should meet with anomalies beyond our power of apprehension. So long as they continue to be exceptions only, and do not militate against principles, medicine need have no fear to acknowledge their existence.

3. The impulse, in health, is in general felt only in the immediate region of the heart, that is, in the space occupied by the cartilages of the fourth, fifth, sixth, and seventh ribs, or, at most, over the lower half of the sternum. When this bone is very short, it is sometimes perceptible by the hand in the epigastric region. Generally speaking, the sphere of impulse is proportioned to the size of the heart, a small heart being felt over a small space, a large one over a large space. It is in some degree also proportioned to the degree of action of the organ, a heart that pulsates quietly having a less extensive sphere of impulse than one that is excited to quick and vehement action. When the heart is increased in mere muscular thickness without proportioned enlargement of its cavities, the sphere of impulse is scarcely extended beyond the space already mentioned; but in hypertrophy combined with dilatation, it is extended much beyond this, being sometimes felt very distinctly under the clavicles, on the right side of the sternum, and occasionally even on the back. The impulse may be extended beyond its natural sphere by displacement of the heart; although, perhaps, in this case it would be more correct to say that the impulse is altered in its situation than that it is extended beyond its natural sphere. Such alteration of the position of the heart may be either congenital, or the result of disease. (See HEART, DISPLACEMENT OF THE.) In this last case, the causes of the displacement are generally

of such a kind as are calculated to extend the sphere of sound also on other principles, namely, from disease of other organs. In the state of health, the heart is surrounded by parts very ill calculated to convey impulse, on account of their soft and yielding nature. But if the qualities which render the parts unsuited for the transmission of impulse have others of a different kind substituted in their place, the extension of the impulse will be altered with the change in their conducting powers. Every disease which renders the parts adjacent to the heart more solid or more coherent, will therefore augment the sphere of impulse. Of this kind are hepatization of the lungs from acute or chronic pneumonia; compression of the same parts by pleuritic and other effusions, or by tumours exterior to them; the growth of foreign bodies within the pulmonary substance, particularly of a solid kind. If, in addition, the lungs are closely united to the walls of the chest, the conduction will be still more complete. Adhesion of the pericardium to the heart occasions an extension of impulse otherwise than by simple conduction. In this case every movement of the heart sets in motion all the parts to which the pericardium is naturally attached; and if these and the adjacent parts should chance to be condensed by any of the causes just mentioned, the impulse may be then very widely extended. An opposite condition of the pericardium gives rise to somewhat similar results. When this sac is greatly distended with fluid, as in chronic pericarditis, the heart floating loose, as it were, in its tumultuous movements, sometimes carries its impulse to a greater distance beyond the cardiac region. Sometimes the impulse is even conveyed beyond the limits of the chest, as in the case of an enlarged liver encroaching on the thorax, and coming nearly in contact with the heart. (Med. & Phys. Journ. vol. xlix. p. 385.)

The cause of the impulse communicated to the walls of the chest by the action of the heart, was formerly and for a long time considered to be the reaction of the column of blood thrown into the curved aorta, tilting the loose apex of the heart forwards. This explanation has, however, been of late questioned; and it seems, indeed, quite inadequate to explain the fact. There seems little reason to doubt that the impulse is occasioned by the muscular action of the heart itself, although there may be various opinions as to the particular movements which produce it. All that is important in a practical point of view are the various relations which this phenomenon bears to the pathological condition of the heart and other organs within the chest.

II. *Sounds of the heart.*—These may be considered under two heads—*first*, the natural sounds; *second*, the adventitious sounds.

A. *Natural sounds.*—These may be considered according to—1. their individual character; 2. their relation to the impulse and to one another; in other words, their rhythm; and, 3. their sphere or the extent of chest over which they are perceptible.

1 and 2. The general characters of the sounds of the heart and also their rhythm have been already given. We shall only here observe that there is great variety in individuals in respect of these characters. In some the sounds are very loud and distinct; in others they are the reverse. They also vary in their tone or key, being sometimes grave or dull, and sometimes clear. The cause of these differences will presently be explained. Unlike the impulse, the sounds produced by the action of the heart are almost always, if not always, perceptible in the cardiac region in the state of health. They are generally very distinct as heard by the naked ear; but they are commonly perceived more accurately by means of the stethoscope. It is found that the intensity of impulse and sound depends on opposite conditions of the heart, and therefore they are never, in a state of health, present together in a great degree. The impulse, as we have already shown, is great in proportion as the walls of the ventricles are thick; the sound is greater in proportion as they are thinner. The sounds of the left cavities of the heart are chiefly perceptible near the junction of the cartilages of the fourth, fifth, sixth, and seventh ribs; those of the right, more under the sternum.

3. In the state of health we find the impulse to be strictly confined to the region of the heart, or to its immediate vicinity. The sound, however, is much more erratic, being frequently perceived at a great distance. In certain persons, indeed, the sound seems as strictly circumscribed as the impulse, appearing confined almost to the point on which the stothescope rests. Such cases are, however, rare; and it is usual, even in the healthiest individuals, to perceive the sounds over a certain proportion of the exterior aspect of the chest at least; as, for instance, the lower third of the sternum, or a little to the right of this, and midway between the nipple and left clavicle. There are many circumstances, still within the range of perfect health, which considerably augment the sphere of the heart's sounds. The range of sound is more extensive in infancy and childhood than in adult life. It seems, also, to bear a pretty accurate relation to the size of the thoracic cavity, the range being much greater, *cæteris paribus*, when this is small than when it is large. Hence in persons with very narrow or contracted chests, whether natural, or from the effects of disease, constrained posture, or improper modes of dress, the range of sound may be heard over the greater part of the chest, both before and behind, and certainly if the heart is naturally thin, or when the circulation is hurried by the least agitation. In women, even when well formed, the range of sound is greater than in the other sex; it is, therefore, in general very considerably greater in them, since the natural dimensions of the chest are diminished almost universally by the compression of stays. The thickness of the parietes of the chest has also a considerable effect in modifying the range of sound; this being very considerably increased by emaciation or leanness, whether natural or from disease. Perhaps the augmented range of sound in children and females is partly owing to the cavities of the heart being proportionally larger, and its walls proportionally thinner, than in adult males: in both the former classes of persons, the muscular system, as is well known, is less developed than in the latter. In all these cases the sound is frequently heard over

the whole chest. It is highly necessary, therefore, before drawing any conclusions from the range of sound in individual cases, to ascertain the exact structure and conformation of the chest, as well as to procure a state of perfect quietude. We think it necessary to insist the more upon this point, because we believe it is one on which frequent mistakes are committed in practice; and as one or other of the various causes of augmented range is of such constant occurrence, we would say that this is one of the indications which should be most distrusted by the young auscultator. The negative indications derived from a preternaturally confined range of sound, are much more trustworthy; since the number of accidental circumstances which can temporarily diminish the range in the case of persons in whom it is habitually great, is much smaller.

It is an important practical precept in studying the indications supplied by the range of sound, to take into consideration the frequency of the pulse. As every cause which augments the action of the heart augments also the range of sound, we shall be naturally much more distrustful of an extensive range in cases where the pulse is quick than where it is slow, inasmuch as quickness of pulse is a very common effect of mere temporary causes, and slowness a very rare one. An extensive range of sound with a quick pulse may be frequently neglected, as far as relates to the diagnosis of the cardiac affection; an extensive range of sound with a slow pulse always demands investigation, and will frequently be found to indicate disease.

Exclusively of their influence in hurrying the circulation, and thereby producing a louder sound, many diseases of the chest augment the range not only of impulse, as already stated, but also of sound, merely by conducting more widely the natural sound. All diseases will have this effect, which render the organs more solid. Every form, therefore, of inflammation of the lungs will have more or less this effect, which will be the greater, the nearer the affection approaches to complete hepatization. Compression of the lung from pleuritic effusion will act in the same manner; and in this case, as in the preceding, the points on the surface of the chest on which the sounds will be most audible, will depend on the position of the indurated or compressed portions within. All solid depositions in the pulmonary substance will have a similar effect, proportioned, generally speaking, to the sum of their mass. The most common form under this head is phthisis; and if one had previously ascertained in health the range of sound, some idea might be formed of the amount of tubercular deposition from the range in the state of disease. Even when the tubercles have suppurated, and have left large empty cavities in the lungs, the transmission of sound continues to be greatly facilitated,—the solidity of the walls of the excavations, and the compressed state of the surrounding pulmonary substance, more than compensating the actual loss of substance from the disease. It is thus, as Laennec observes, that in the case of tuberculous excavations of the right lung, we hear the sound better under the right clavicle and in the axilla, than on the left side, and sometimes even better than in the region of the heart itself.

The sounds of the heart are always in some degree masked by the respiratory sounds, and in proportion to the loudness of these. In the cases of disease in which there is a very loud rhonchus, the sounds are completely obscured on the anterior part of the chest; it becomes therefore proper, in such cases, in order to perceive the precise nature and extent of the sounds, to observe them in the intervals between inspiration and expiration: and these may be prolonged designedly by the patient, if it is found necessary.

In extending itself from the cardiac region over the rest of the chest, the sound of the heart almost always follows a fixed tract, being heard successively, according to Laennec, in the following places—the left side of the chest before; the right side before; the left side behind; the right side behind. "In these cases," says Laennec, "the intensity is progressively less in the succession mentioned. For instance, it is less under the right clavicle than under the left; it is somewhat less on the lateral parts of the left side than under the clavicle; it is still less perceptible on the right side laterally; and much attention is commonly requisite to enable us to hear the pulsations at all in the back; particularly the right side. This succession has appeared to be almost constant, and may be taken as an index of the extent of pulsation. For instance, if this be perceptible on the right side, we may be assured that it will be equally so over the whole sternum, under both clavicles, and over the left side; but we are not sure that it will be so on the back. But if it be perceptible on the back on the right side, we may calculate on its being still more audible on every other part of the chest." As this is the succession of health,—and almost invariably,—it is obvious that any deviation from it, at least any great deviation from it, may be considered as produced by disease, and may thus become a sign of some importance. For instance, if the sound is much more audible on the right back than on the left back, or even on the left side, we have great reason for believing disease to be the cause of this anomaly; and the circumstance may tend materially to elucidate the diagnosis in doubtful cases. If the heart retains its natural position, some change must have occurred in the contents of the right side of the chest, to occasion this increased power of conducting sound.

When the sounds of the heart are heard much beyond the usual sphere of health, in cases in which the chest seems pretty well formed, and in which none of the causes producing an extensive range can be detected, the individual rarely enjoys good health. Although he may not have any other of the more ordinary signs of disease of the heart, it will be found that his system is a feeble one, and obnoxious to many morbid impressions. "In examining him attentively," says Laennec, "we shall discover indications of that cachexy peculiar to some diseases of the heart; and we shall find that, if he has not formal dyspnœa, his respiration is, at least, shorter than usual; that he is more easily put out of breath, and more subject to palpitation. This state, he adds, which is that of many asthmatics, may remain stationary many years, and does not always prevent the attainment of an advanced age." Our own experience would lead us to consider such a state of heart, which is generally congenital, if not the cause of many other morbid states of common occurrence, as, at least, a circumstance greatly predisposing to them, and aggravating others originating from different causes. It tends powerfully to the production of venous plethora and its numerous train of evils; it leads directly to a defective distribution of blood in the extremities and on the surface, and to a superfluous store in the head and larger viscera; it is a very common cause of head-aches, particularly such as are commonly termed nervous, and eventually leads to apoplexy and palsy. Such persons have almost always cold extremities. We are even of opinion that that complex disease, scrofula, if not occasioned, is at least frequently hastened in its development, and is always aggravated, by the concomitance of a feeble heart.

B. *Adventitious sounds.*—Besides mere changes in the degree, extent, and relative succession of the sounds, their very character may be altered; new sounds may be superadded to the old, or may entirely take the place of these. The most common and most important of these changes is the conversion of the usual sound into one resembling the puff of a pair of bellows, or the rough, grating sound produced by the action of a file, rasp, or saw upon wood. The bellows-sound, termed by Laennec *bruit de soufflet*, most accurately resembles the puffing of a small pair of bellows, as employed to blow the fire. The new sound usually takes the place of the natural one; sometimes the two are conjoined; it may be present during the first and second sound, or only during one of these. The saw-sound, or rasp-sound, *bruit de scie*, *bruit de râpe*, of Laennec, is as happily named as the former variety, as nothing can be more precise, in many cases at least, than the resemblance between the sounds of the heart and those to which they are compared. The notion of smoothness is always conveyed by the bellows-sound, and that of roughness by the saw-sound. Yet they gradually pass into each other, from the slightest deviation from smoothness in the bellows-puff through all the intermediate gradations of roughness produced by a very fine-toothed saw, a wood-rasp, up to the harshest notes of a large-toothed saw. In many instances these anormal sounds of the heart imitate, with singular accuracy, both in their individual qualities and in the regularity of their recurrence, the sounds produced by a carpenter sawing through a small piece of wood at a short distance from the hearer. The loudness of these sounds is frequently very great, as heard with the stethoscope, being sufficient almost to startle one on first applying the ear to the instrument. Like the bellows-sound, that just described may occupy the place either of the first or second sound; but it accompanies the former much more frequently than the latter. The sound of the saw or rasp is often heard at a great distance from its site, like the natural sounds of the heart; the bellows-sound is for the most part confined to the place where it originates. Both of them, however, are occasionally perceived in the arteries, at some distance from the heart. The bellows-sound, in particular, is frequently observed at a considerable distance from the heart, and even when no such anormal sound can be detected in that organ. When the saw-sound exists in the heart, it may always be traced along the arch of the aorta to the carotids and subclavian arteries. Laennec has noticed a singular variety of the bellows-sound, in which the successive tones are modulated into regular musical notes. He therefore terms it the musical bellows-sound.

The causes of these morbid sounds have been investigated with much care by Laennec and his followers. At first Laennec considered them as exclusively the result of contraction of the valvular orifices from organic disease. Subsequent experience, however, led him to conclude that they may exist without any discoverable change in the orifices or valves, while such change may exist without their concomitance; and he at length adopted the opinion that all the varieties were owing to a spasmodic contraction of the parts in which they originated. As a general statement of the fact, this opinion is certainly erroneous. Indeed it now seems fully established that the immediate causes of all these sounds are certain anormal motions or currents produced in the column of blood, whereby this, which usually glides on smoothly and silently, is thrown into sonorous vibration. Whatever produces the movements in question may produce the sounds; and one of the causes may certainly be that which Laennec supposed. A much more frequent cause, however, is permanent alteration in the caliber of the canals through which the blood passes, by some organic change effected in them; and by much the most common cause is contraction of some of the orifices of the heart.

The bellows-sound appears to originate in much slighter causes than the sound of the rasp or saw, and is, therefore, of less value as a sign of disease. Laennec ascertained that pressure on an artery will reproduce the bellows-sound after it had ceased; and it is now known that the same pressure will frequently produce it in an artery where it had not before existed. It is very constantly present in cases of bronchocele of considerable size, and gradually disappears as the tumour is absorbed under the use of iodine. It is also present in the arteries of the impregnated uterus. It is frequently removed, when strongly marked in the heart, by venesection. It cannot, therefore, be admitted as a sign of organic disease, although it is by no means to be disregarded among the symptoms of diseases of the heart, more especially if it is permanently present.

The sound of the saw or rasp is of less frequent occurrence than the simple bellows-sound; although there is no reason to believe that their causes differ otherwise than in degree. Slighter causes suffice to produce the bellows-sound. The sound of the saw or rasp is occasionally perceived in the carotid and subclavian arteries; it is also observed in the arteries of the enlarged thyroid gland, and in those of the impregnated uterus. It is, however, most constantly observed in the heart, in the case of a contracted state of the orifices.

In reference to these adventitious sounds, collectively and individually, we think the following conclusions may be deduced from the consideration of them :—

1. The source of the sounds is some impediment to the usual current of the blood, from some physical alteration in the channel through which it passes, whereby such vibrations are excited in the column of fluid as to give rise to audible sound.

2. The alteration in the channel may be merely temporary, and produced in parts possessing a healthy structure, from nervous causes, from want of the natural harmony of proportion between the size of the channel and its contents, and probably from other unknown causes. The more common cause, however, is some fixed physical alterations in the channels conveying the blood ; either a contraction or enlargement of caliber, or some other deviation from the natural structure, whereby the current is more or less impeded or disturbed.

3. We are not justified, by the mere presence of any of these sounds, in concluding that organic disease of the valves or valvular orifices exists.

4. If the morbid sounds disappear after repose, bloodletting, or other form of depletion, or without any evident cause, we may suspect that they originate in mere functional disorder; and the probability of this opinion will be increased in proportion to the period of their absence.

5. If they are not removed by these or any other causes, or if they are removed for a very short period only, or are merely lessened in degree, we may conclude that they originate in disease of the valvular orifices; and this conclusion will be still further strengthened if there exist other symptoms of diseased heart.

6. The probability of organic disease is increased in proportion as the character of the sounds approaches that of the sound of the saw or rasp.

7. The sounds produced by valvular disease become much weaker when the contraction of the orifice is extreme than when it is moderate, a certain extent and force of current being requisite to produce them in the highest degree. Dr. Hope says that he has often found that when the orifice was reduced to a crevice of two or three lines in width, no sound whatever was produced.

8. The following is a brief sketch of the *rationale* of the morbid or anormal sounds resulting from valvular disease, for which we are indebted to the able physician just named.

(*a.*) When the *aortic orifice* is contracted, an adventitious sound, or morbid murmur, accompanies the ventricular systole and first sound; and when the valves, not closing accurately, permit regurgitation from the aorta, a morbid murmur accompanies the diastole and second sound also; but this last, when it occurs, is extremely slight and brief, as the influx of blood from the auricle, during the diastole, almost instantly puts an end to any regurgitation capable of producing sound.

(*b.*) When the *pulmonic orifice* is contracted, the effects are the same ; but disease of the valves on this side of the heart, as will be shown in another place, is comparatively very rare.

(*c.*) When the *mitral orifice* is contracted, a morbid murmur accompanies and sometimes entirely supersedes the second sound, being occasioned by the passage of the blood from the auricle into the ventricle during the diastole of the latter. When the valve, not closing accurately, admits of regurgitation, a murmur accompanies the first sound, and this is sometimes excited by a degree of disease insufficient to produce it during the second.

(*d.*) When the *tricuspid orifice* is contracted, the results are the same as in the last case.

There is yet an adventitious sound, of a different kind, and originating in a totally different cause, which deserves to be noticed. This is the sound which Laennec compared to the creaking of the leather of a new saddle, and which he termed *cri du cuir*. At first he conceived this sound to be connected with pericarditis ; but he afterwards gave up this opinion, and considered it as owing to accidental circumstances not of a morbid kind. Other observers, however, have been led to adopt Laennec's first opinion ; and several cases have been published which render it extremely probable that this peculiar sound is produced by the friction of the heart against the pericardium, when one or both have lost their polish from the effusion of solid lymph with little or no serum. If this opinion be correct, the sound ought to present itself in most cases of pericarditis at some period of their course ; and it should always be present when there is considerable albuminous exhalation with little or no serum.* This sound, both in its character, causes, and its value as a sign, is precisely analogous to the *bruit de frottement*, noticed in a former part of this article.

The sounds of the rasp or saw are very frequently accompanied by a phenomenon which, like that of impulse, can only be brought under the head of auscultation on a principle of convenience, since, like impulse, it is appreciable by the sense of touch, not of hearing. This is the phenomenon termed by Corvisart *bruissement*, and by Laennec *frémissement cataire*, terms which it is not easy to render in English, nor yet to find good substitutes for. It is a peculiar vibration or thrill communicated to the finger laid upon the heart or artery where it exists, and which resembles pretty accurately the gentle tremor communicated to the hand of a person while stroking the head of a cat when purring.

When existing in the region of the heart, "the thrill" is identical with the sound of the saw, rasp, or bellows : the difference being in the sense which perceives, not in the thing perceived. If we could always say, from the character of the thrill, with which of the two sounds of the heart it is identical, it would be more valuable as a sign than it is. It is proper to observe that we do not always hear any of the sounds when we feel the vibration ; nor, conversely, do we always feel the vibration when we hear the sound. This, however, is not any proof that both do not spring from the same physical cause. The cause may exist in a degree sufficient to excite one sensation and not the other ; just as we may feel or see the vibration of a musical string after the ear has ceased to hear any sound from it. It is, therefore, we conceive, without good grounds, that Laennec considered the separate existence of these phenomena as proofs of their non-identity. (See Dr. Corrigan's Experiments in the Lancet.) Dr. Hope says that, although resulting from the same causes as the morbid sounds, *the purring tremor* or thrill requires, *cæteris paribus*, a stronger current for its production; for which reason it less frequently accompanies the passage of the blood from the auricles into the ventricles, than from the latter into their respective arteries, or into the auricles by a retrograde movement. Even in the latter cases, Dr. Hope adds, it is seldom strong unless the ventricle be hypertrophous, or the circulation hurried. Laennec says the thrill is almost always confined to the left side of the heart; although it is occasionally extended much beyond this. The hand must be pressed very firmly upon the heart, in order to feel it well. When existing in the arteries, a middling degree of pressure enables us to perceive it best; a very slight one does not attain it, a strong one abolishes it. It is sometimes continuous, sometimes renewed by the arterial pulse; sometimes it is confined within the caliber of the artery, sometimes it is perceived considerably beyond. In no case have we had occasion to observe the thrill more constantly and distinctly than in the thyroid arteries in cases of large bronchocele.

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* Colin. Exploration de la Poitrine.—Thèses de la Faculte de Méd. No. 175. — De l'Auscult. Méd. 3ème édit. tom. iii. pp. 66, 262. notes.

Auscultation of the Heart in the Fœtus. Diagnosis of Pregnancy.

M. Mayer, of Geneva, appears to have been the first who applied the tests afforded by auscultation to discover the existence of the fœtus in utero. In the *Bibliothèque Universelle* for November, 1818, it was stated that this gentleman had ascertained that the sounds of the fœtal heart are readily perceptible by applying the ear to the abdomen of the mother. The subject was afterwards prosecuted, with the aid of the stethoscope, by M. Kergaradec, and with additional results indicative of its importance; and the following facts, verified by numerous auscultators in this country and on the continent, are now as well ascertained as any detailed in former parts of this article.

There are two auscultatory signs of the presence of a living fœtus in the womb—1. the double sound of the heart; and, 2. the existence of the bellows-sound in the placental arteries, or rather, in the uterine arteries immediately connected with the placenta.

1. The pulsations of the fœtal heart may be perceived as early as the fifth month, or between that and the sixth. They are characterised by the double sound of the adult heart, and by the peculiar rhythm of this, which can never be mistaken for any other sound. The sounds, when compared with those of the adult heart, examined in the cardiac region, are extremely feeble; but they are, when at all perceptible, perfectly distinct. They are distinguished from all arterial pulsation of the mother by the duplex rhythm, and by the extreme frequency of their recurrence. The fœtal pulsations are generally more than double that of the mother. The sounds are found to be much more distinct at one time than another, in the same place, and in different places at different times. These variations no doubt result from the varying position of the fœtus, and from its relation to the uterine parietes.

The sounds will be much more distinct when the trunk of the fœtus is in direct contact with the uterus, and, most of all, when the anterior part of its chest is applied opposite to the spot on which the stethoscope rests. When the whole body of the child is removed from that side of the uterus over which the instrument rests, it is doubtful if the action of the heart can be at all perceived. The more copious is the liquor amnii, the less perceptible, *cæteris paribus*, will be the fœtal sounds. The space over which the sounds may be heard is generally pretty extensive, being, indeed, frequently the greater portion of the region occupied by the uterus. It is, however, in general, easy to discover the point which is nearest to the source of the sounds, by the decreasing and increasing intensity of these, as our examinations recede from or approach towards one particular spot. In general, the pulsations of the fœtal heart vary from 120 to 160 in a minute. In one case noticed by Dr. Ferguson, (Dublin Trans. vol. i. New Series,) the relative frequency of the mother's and child's pulse was singularly reversed; the former being 100, while the latter was only 20. We have met with no similar instance on record.

2. The second auscultatory sign of the presence of the fœtus has been termed the *placental sound* or *placental bellows-sound*, likewise the *utero-placental soufflet*. It was first noticed by M. Kergaradec, and although a less absolutely certain indication of pregnancy than the sound of the fœtal heart, it is a sign of great importance. Although termed placental, there can be little doubt that the site of the sound is in the uterus, in the enlarged arteries which supply the placenta.* The sound assumes, at different times, all the character of the bellows-sound of the heart. It becomes perceptible about the fourth month of gestation, and is then more distinct than at a later period. Dr. Ferguson says that he has not observed any variety of the sounds to be peculiar to particular stages of pregnancy. In the early stages, Laennec describes the sound as resembling that which is produced by discharging a blast from a pair of bellows into an empty bottle. At a later period, the sound is duller, more diffused, and no longer conveying the impression of being limited to the caliber of a single artery. It assumes all the varieties of the valvular sounds of the heart, from the simple bellows-sound to the sound of the rasp or saw. Dr. Ferguson says that the most constant variety "is a combination of the bellows or the sawing with the hissing sound, commencing with one of the former, and terminating with the latter." These sounds are confined to a much smaller space than those of the fœtal heart. The point where they are most audible is always fixed in the same person, but varies in each individual. In some, the sound can only be detected in a single spot a few inches square. There is no particular part of the uterine tumour in which the sound

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* A striking analogical instance is afforded by the thyroid arteries in bronchocele, noticed in a former part of this article. *Query*, will the same result be obtained in active hypertrophies of other parts of the system?

may not be found; but Dr. Ferguson says that he has found it most frequently in the iliac regions. The placental sound is always isochronous with the pulse of the mother, and is unaccompanied by any degree of impulse.

Whatever be the precise mode of production of this sound, there can be no doubt that it has its seat in the enlarged vessels of the uterus in that portion of it immediately connected wtth the placenta. This is proved by the following facts: 1. The sound, as already stated, is confined to a fixed space in each individual. 2. This spot is ascertained, by examination after delivery, to be always that to which the placenta had been attached. 3. That the sound is not seated, at least exclusively, in the placenta is proved by the fact that the sound is still audible for a short period after the placenta is detached. 4. It ceases immediately upon the contraction of the utero-placental arteries, as is proved in cases of death of the fœtus without delivery, and by its instantaneous cessation on the contraction of the uterus after delivery. 5. It is in all cases synchronous with the mother's pulse. There seems little ground for believing, with Dr. Kennedy, (Dublin Trans.) that the placental arteries themselves have a share in the production of the sound, any farther than by their action promoting that of the uterine arteries. The character of the sound is *changed* by the cessation of the fœtal circulation, as by the removal of the placenta, the death of the fœtus, or tying of the cord, (Dr. Kennedy denies M. Ollivry's statement that it is immediately *extinguished*,) the sound becoming "abrupt, of short continuance, and wanting the lengthened terminating whiz observed in the perfect sound." This may easily be explained by the change necessarily produced in the uterine circulation by the removal of the fœtal circulation, without supposing that the placental arteries had any direct share in its production.

Great care and attention are requisite on the part of the auscultator in investigating these phenomena. The sounds being very feeble, perfect silence is necessary during our explorations, and we must be very careful not to confound the sounds with others which may exist at the same time, such as the sound of the mother's heart (which is often distinctly audible in the region of the uterus), of the intestinal movements, and the sound of muscular contraction produced in compressing the abdomen with the stethoscope. As the phenomena are sometimes intermittent, or, at least, not always perceptible, we must not deny their existence because they are not discovered on the first examination.

The sounds may be heard almost as well by the naked ear as the stethoscope; but to all who are accustomed to use this instrument, there are numerous and very obvious reasons why it should be preferred. It is, however, well that practitioners should be aware that the phenomena may be detected by any one, whether a practised auscultator or not.

Different practitioners make the patients adopt different positions during exploration. In many cases the sounds are heard very distinctly while the patient is seated in a chair in her ordinary dress; but it is always preferable, when it can be done, for the patient to assume the horizontal posture, and remove her stays and thick petticoats. The presence of the solid stays is particularly objectionable, as they are apt to convey the sounds of the mother's heart from the chest downwards.

No one who is aware of the frequent and great difficulties experienced by practitioners in detecting pregnancy, and of the vast importance of doing so in some cases, will have any doubt of the great value of the signs now described. They are almost as certain as the perception of the fœtal movements, and more certain than *the touch*; and they possess a very great superiority, in point of convenience and delicacy, over the latter. It is true, they have not been detected in some cases of pregnancy; it is probable that, owing to some peculiar idiosyncracy, they may never manifest themselves in certain cases; but ample experience proves that their absence is a circumstance of extreme rarity. Their absence, therefore, must not be considered as an absolute test of the non-existence of pregnancy; although their presence may be looked upon as the reverse. Here, as in every other case in which auscultation is applied, we have all the other signs to guide our judgment in the instances where the fœtal and placental sounds are not detected; while in the vast majority of cases, we have an additional sign, of almost infallible accuracy. It cannot, therefore, be denied that this form of physical diagnosis has conferred even on puerperal medicine a boon of immense value.

[Subsequent auscultators have not confirmed the value of the utero-placental murmur. Uterine and other tumours than the gravid uterus have unquestionably produced it. (See the Art. PREGNANCY; also, Bouillaud *Traité Clinique des Maladies du Cœur*, Paris, 1835; Hope *on the Diseases of the Heart*, Amer. edit. by Pennock. Philad. 1842, p. 152; Raciborski, *Manual of Auscultation*, by Fitzherbert, p. 145, Lond. 1835.) In a case of fibrous tumour of the uterus, the writer heard it distinctly, (Dunglison's *Human Physiology*, 5th edit., ii. 423); and Prof. R. M. Huston (Amer edit. of Churchill's *Theory and Practice of Midwifery*, p. 136) states, that he is satisfied he heard it in a similar case, and, also, in one instance from the presence of an enlarged ovary. The murmur is produced by the pressure of the tumour on the large vessels of the mother.]

This article has extended to so great a length as to prevent us from offering some general remarks on the actual and comparative value of auscultation as a diagnostic measure. We may probably have another opportunity of doing so.

JOHN FORBES.

BARBIERS. This is a variety of paralysis, chiefly prevalent in India. Sauvages thus defines it: "Motus gradientium genu retrahens cum tremore, formicationis sensu, vocis raucedine. India familiaris." Linnæus defines it: "Partium tremor, genuum contractura, stupor, raucedo." Sagar adds to the definition of Sauvages, "Stupore dolorifico artuum." Dr. Aiken arranges the disease as synonymous with "contractura." Bontius describes barbiers well, but he gives it also the name of beriberi; and Dr. Mason Good has completely confounded the two diseases: it is of importance therefore that they should be discriminated.

The leading features of beriberi are uneasiness with partial loss of power of the lower extremities, obstructed respiration, and general œdematous intumescence. Beriberi is commonly an acute disease. Barbiers is characterized by pain, numbness, and partial paralysis of the inferior and superior extremities: sometimes the vocal organs are similarly affected. Barbiers is generally a chronic disease.

Bontius describes the disease as "a species of palsy, or rather a tremor; for at the same time that it impairs the sensation of the feet and hands, sometimes even of the whole body, it induces a trembling. It is more especially the product of a rainy season. In general the disease invades slowly; under particular circumstances it attacks suddenly. Among the chief symptoms of this disease is a lassitude of the whole body; the motion and sensation, especially of the feet and hands, are languid and depraved; and for the most part a titillation is felt in these parts, similar to what seizes them in cold countries in the winter, but with this difference, that the sensation in barbiers is more painful: the speech is sometimes so much obstructed that the patient can scarce pronounce a syllable articulately."

The translator of Dr. Bontius's work states that barbiers "is most violent and frequent on the Malabar Coast, where (especially in the months of January, February, and March,) it attacks those who unwarily sleep exposed to the land winds which issue every morning about sunrise from the neighbouring mountains: suddenly seizing them with a painful sensation in the periosteum of the arms and legs. In some persons the pain abates as the day advances and the air becomes warm; but in others it continues for a considerable time, attended with a weakness of the knees and an uneasy sensation in the calves of the legs and soles of the feet, especially on any attempt to walk. It is scarcely ever cured by medicine till after the shifting of the monsoon, unless the patient be removed to the coast of Coromandel, or to any place to the eastward of the Baligat mountains, where by the changes of the air they quickly recover."

Dr. Lind, in his account of the diseases incidental to strangers in different parts of the world, says, "Barbiers is a species of the palsy, a disease most frequent in India. It distresses chiefly the lower class of Europeans, who, when intoxicated with liquor, frequently sleep in the open air exposed to the land winds. Its attack is generally sudden, and entirely deprives the limbs of their motion; sometimes only part of them."

The following is Mr. Marshall's account of the disease, (Notes on the Medical Topography of Ceylon:) "For the most part it commences with pain in the muscles of the thighs and legs, particularly of the bellies of the gastrocnemii. This uneasiness is usually attended by a general numbness of the extremity and an imperfect command of the powers of locomotion. Sometimes the patients describe their sensations to be as if hot water or sand was running over the affected parts; at other times they complain of a sense of formication accompanied with a pricking kind of pain. In some cases the hands and forearms become similarly affected. I never saw a case where the disease was confined to one extremity. In general there was but little difference in the degree of the affection of the extremity of one side from that of another. In one case the muscles situated on the back part of the neck became affected, and eventually the powers of articulation were much impaired. This last symptom admitted of partial alleviations. The appetite for food is seldom much impaired during the early stage of the disease.

"When the disease has made considerable progress, the patient is unable to walk steadily. Standing or walking in general greatly aggravates the uneasiness of the limbs. The patients have an infirm tottering gait, and those whose hands are affected lose the power of feeding themselves. They seldom enjoy sound sleep, although they seem to labour under a sluggish inactivity and an unwillingness to exert themselves.

"The progress of the disease is sometimes protracted to a period of several months. As the complaint advances, the patients express their sensations of the affected parts to be as if they were dry or dead, and almost entirely without feeling. Loss of appetite, indigestion, and emaciation soon follow; the extremities lose the natural temperature; the exterior muscles become paralytic, while the flexor muscles seem to have some force, by which means the joints (particularly the joints of the fingers) become contracted. The pulse is frequent, thready, and fluttering; the vital functions greatly impaired; and eventually death supervenes."

"The general remote causes of this disease appear to be cold and moisture applied to the body, intoxication, and the excesses and irregularities consequent on inebriety; violent exercise in the sun, lying down in the open air during the heat of the day; exposure to the cold chilling dews of the night, and particularly by going to sleep in this situation; suddenly obstructed perspiration, by exposing the body but partially covered to a current of cold air; long fasting, and perhaps every circumstance which exhausts the human frame."

Horses and dogs are sometimes liable to a similar paralytic affection of the extremities, in India, which is universally ascribed to the land wind: they rarely, if ever, completely recover.

The case of spasmodic disease described by Dr. Bostock in the Transactions of the Medico-Chirurgical Society, vol. ix. seems to have been an affection nearly allied to, if not the same as, the disease now under consideration. The patient, who was in the middle of life, was first attacked with achings in the lower limb on one side, accompanied with a difficulty and irregularity of motion which soon extended to the other side, and then gradually to the throat, so as to impede deglutition, except with great pain and severe exertion. The larynx next became affected so as to prevent speech, and afterwards the muscles on the back of the neck. The limbs were rigid, so that they were both bent and straightened with difficulty. The intellectual powers were at length affected and weakened; the failure of understanding gradually increasing, principally showing itself in paroxysms, during one of which the patient died. No cause of the disease could be traced before death, nor did dissection discover any organic change calculated to account for the symptoms. For the treatment of this affection, see Paralysis.

J. Scott.

BATHING.

BATHING. In its most comprehensive sense, the term *bathing* means the immersion, for special purposes, of the body, or a part of it, in a medium different from that in which it is commonly placed. Any substance which constitutes this medium, when considered only in relation to the special purpose, is, in medical language, termed *a bath.*

A great variety of materials has been employed to form baths, the enumeration of which in this place would be of little practical utility, however it might show literary research. In the present article we shall confine our observations almost entirely to baths composed of water, watery vapour, and air.

We shall commence with the fluid water bath, as being that in most general use, and by far the most generally useful. The most important circumstance respecting this bath, and indeed other baths also, is its temperature. To the consideration of this, therefore, we shall first direct our attention.

The range of temperature within which water in a liquid form has been employed for baths, includes about 80° or 90° of Fahrenheit's scale, viz. from 33° up to 112° or 120°. A lower degree, for obvious reasons, cannot be used; and as no therapeutical indication can ever require a higher, we need not extend the scale in this direction, although baths of even a higher temperature than 120° may occasionally have been had recourse to.

Various subdivisions of baths, according to their temperature, have been adopted by writers on this subject—all the subdivisions being founded on the presumed difference of effect of the bath at particular temperatures. It is obvious, however, that every classification of this kind must be, in some degree, arbitrary; it being utterly impossible precisely to limit the effects of any class of agents upon a subject like the living body, whose properties and susceptibilities are perpetually varying in the same individual at different times, and differ extremely in different individuals at the same time. In this respect bathing is precisely like every other therapeutical agent. We have the means of calculating with certainty the elements of one side of the equation only; the result, therefore, cannot be otherwise than uncertain. As, however, in the case of medicines, experience has enabled us to establish an approximation towards a medium standard of results, in calculating their effects on men in general, so, in like manner, we have obtained certain averages in the case of bathing. And although, as we have said, the conclusions can, at best, be viewed as mere approximations, still the knowledge of them is of great utility in practice. They must, at all events, be employed as convenient expressions of known facts by those who would communicate information to others.

The simplest and most natural division of baths is into *cold* and *hot;* the former comprehending all those which communicate the sensation of cold, the latter all which occasion the feeling of heat. Although, for reasons above stated, it is impossible to fix the degree which shall form the boundary between the two classes of sensations, we shall nevertheless, on the ground of practical convenience, assume such a precise limit. Generally speaking this boundary will be found between the 84th and 88th degree of Fahrenheit; and although well aware that this range is sufficiently small, we shall still further abridge it by naming the intermediate degree of 88 as the precise limit, denominating all baths of a temperature below this *cold,* and all above it *warm.*

In subdividing these two sections of baths according to temperature, we would propose the following arrangement to the practitioner, as one founded on practical indications, and therefore likely to be useful,—leaving it always to be understood that, in fixing the precise boundaries by individual degrees, we are influenced more by motives of convenience than from any belief that these are the exact and true limits of the different classes of baths :—

1.	*The cold bath,*	from 33°	to	60°
2.	*The cool bath,*	60°	to	75°
3.	*The temperate bath,*	75°	to	85°
4.	*The tepid bath,*	85°	to	92°
5.	*The warm bath,*	92°	to	98°
6.	*The hot bath,*	98°	to	112°

OF COLD BATHING.

§1. Of the Phenomena and general operation of the Cold Bath.

When a person in health first enters a bath of cold water, he experiences a sensation of cold proportioned to the lowness of the temperature, and a sudden impression on the nervous system, usually termed a shock, proportioned, *cæteris paribus,* partly to the degree of cold, and partly to the suddenness of the immersion. Frequent concomitants, if not universally constituent parts of the shock, are, a greater or less degree of shivering and convulsive anhelation, and a confused mental feeling of surprise and apprehension. If the temperature is very low, these sensations are proportionally vivid, but they are experienced in some degree at all temperatures below that conveying the feeling of warmth. Almost immediately after the shock, the feeling of cold vanishes and gives place to one of a different kind. This gradually increases and becomes speedily diffused over the whole frame, the unpleasant sensations being succeeded by others of a decidedly pleasurable kind. The water almost ceases to be felt, or is felt as communicating a sensation of warmth rather than of cold. If the immersion, however, is prolonged, this sense of warmth gradually decreases; but if the system is at all vigorous, and the temperature of the water not extremely low, the renewed sense of cold is, for a time, rather pleasant than otherwise, the individual feeling as if the external impression were more than counterbalanced by an active force within, of an opposite kind. After a time, however, longer or shorter according to the state of the system and the temperature of the water, the sense of agreeable coolness is succeeded by one of actual cold; more permanent tremors or shudderings come on; the extremities feel benumbed, and the whole body gradually becomes languid, exhausted, and powerless. No second glow ever succeeds this second chill; but the feeling of cold, numbness, general discomfort and debility increase with the continuance of the immersion. The face and whole surface of the body become pale and shrunk, and obviously reduced in size, as is familiarly evinced by the falling off of rings from fingers on which they had fitted tightly; the pulse becomes smaller and more feeble, and frequently slower than natural; there is a feeling of oppression on the chest, a disposition to pass urine, and the sense of chilliness gradually increases to a strong and general shivering.

If the individual leaves the bath before the supervention of the second access of shivering, or before this has continued long, he generally experiences, on dressing, a renewal of the reaction which had followed the shock of immersion, and this having now nothing to counteract it, becomes more vivid and permanent. The pulse becomes fuller and stronger than before immersion; the face, lips, and whole skin not merely recover the colour and warmth and plumpness which they had lost, but are actually enlarged beyond their habitual state; the rings, which during the chill had dropped from the fingers, now fit tighter than before the bath; all sense of oppression in the chest and head, and of general languor vanishes, and to this succeed an exciting feeling of internal buoyancy, and an agreeable consciousness of animal power.

The above is a brief account of the principal phenomena usually produced by the bath of cold water as used for medical purposes. On proceeding to analyze them, they appear to admit of a ready division into two classes, according as they flow more or less *directly* from the action of the bath—the first comprehending the phenomena usually included under the term *shock*, the second those included under the term *reaction;* and it seems necessary, with a view to the practical application of the bath as a remedy, to enter somewhat more into detail respecting them, and also briefly to notice their physiological causes, and their therapeutic operation.

I. *The shock.*—Although it is impossible to separate entirely, either speculatively or in practice, all the phenomena included under the name of shock, we can still see that the system is affected by it in various ways.

1. The application of the cold water to the surface produces an immediate and very powerful influence on the economy through the medium of sensation. The whole nervous system seems suddenly impressed, and as if about to yield beneath some hurtful power; but, in general, before any of the important functions have become materially disturbed, the conservative energies are roused to successful resistance.

In certain states of the body, however, the impression is found to be too powerful for the nervous system; and there is either no reaction, or this is too feeble to produce any useful results. A complete and prolonged depression of the powers of life may be the consequence, or even life itself may be extinguished. Numerous instances are known of individuals being killed by the cold bath, in this way. Such persons have commonly entered it when they were exhausted by bodily exertion and long-continued perspiration.

2. Refrigeration, to a certain extent, must of necessity result immediately from immersion in the cold bath. This effect must always be conjoined with the former. *Cæteris paribus,* it is proportioned to the lowness of the temperature, and the duration of the immersion.

3. There is an immediate retrocession of the fluids from the surface of the body to the internal parts. The bath produces this effect partly through the nervous impression excited by it; partly by the contraction of the whole superficial capillaries from refrigeration, forcing their contents inwards; and partly through the mechanical compression produced by a denser medium.

4. The cold water produces, to a certain extent, a condensation of the tissues with which it comes immediately in contact, partly by the physical abstraction of heat, and partly through a vital impression on the organization. The contractions of the fingers, scrotum, &c. are obvious instances of this effect. Parts not in contact with the refrigerating medium also contract, in sympathy with those which are.

All the effects now mentioned are necessarily present in every case, but their relative intensity may vary infinitely, according to the condition of the subject, the mode of applying the agent, &c. The predominance of the one or the other class is of great consequence in a practical point of view; and it is important to know that the administration of the bath may be so regulated as to produce this particular effect.

II. *Re-action.*—The almost instantaneous result of the shock is the excitement of the nervous system to increased activity, in virtue, no doubt, of that general principle of self-conservation bestowed, in a greater or less degree, on all living organized beings. The retropulsion of the fluids from the surface upon the internal organs and large vascular trunks, producing mechanical distension, and probably also vitally stimulating the parts, unites its effects with those resulting from the direct conservative efforts of the nervous power. The centres of vital energy, the brain and heart, are roused; the latter organ re-acts with fresh vigour on its contents, and the blood is once more propelled through the whole capillary system, more particularly of the surface, carrying with it life, heat, and renovated action.

As the effects of the cold bath, considered as a medical agent, are greatly varied according to the mode in which it is applied and the condition of the individual at the time he employs it, it is no great wonder that considerable differences of opinion respecting its mode of action should have existed among physiologists and physicians. By some it has been deemed sedative, by others stimulant, by some debilitating, by others tonic. The truth is, that its operation varies with the circumstances of the case. Regarded abstractedly as a medium of communicating cold, there can be no doubt that the cold bath must be considered as debilitating in the highest degree, inasmuch as its continued application will eventually produce death, from exhaustion of the nervous energy and derangement of functions essential to life. But when we speak of the cold bath *medically*, we do not regard its absolute effects, but its effects when applied in a particular manner, and regulated according to certain views. Like many other remedies, it may be debilitating to the destruction of life in one dose, and yet salutary and tonic in another. Accordingly, when used in the proper case, at the proper time, and in the proper manner, the cold bath is unquestionably one of the most powerful tonics in the whole range of the Materia Medica, and it is chiefly as such that it is used in medicine.

§ 2. Of the special effects of the cold bath as a medical agent, and of the mode of ensuring them.

The cold bath is employed, in individual cases, chiefly with the view of producing one of the three following effects: — 1. the shock on the nervous system, independently of the accompanying refrigeration or subsequent re-action; 2. the refrigeration, independently of the nervous shock, or vascular re-action; and, 3. the re-action independently of the shock or refrigeration. The two first of these objects are of inferior practical importance; the last comprehends nearly the whole doctrine of cold bathing.

I. *The nervous impression, or shock.*—When the cold bath is employed with the view of producing the shock, properly so called, or primary nervous impression, and if it is desired that this should be great, the water is used at a low temperature, and the application of it is sudden, forcible, and brief. To this end the patient is either plunged suddenly into the water and instantly withdrawn, or the water is dashed over him in the form of affusion. A familiar example of this use of the cold bath is the sprinkling the face and breast of a person disposed to swoon. On the same principle a more copious affusion is used in certain convulsive diseases, more especially those of an hysteric or purely nervous kind. In such cases the application is often extremely serviceable. It has likewise been used in convulsive affections of a more permanent kind, as in chorea, tetanus, and epilepsy, but with less beneficial effect in general, and not always with safety. The same practice was formerly employed in mania; the mode of administering it being, in this case, to cause the unhappy maniacs to tumble unawares into a deep plunge-bath or pond. With a similar view the cold bath, chiefly in the form of a copious and forcible affusion, was much employed in fever, in the hope of breaking the train of morbid actions in which fever was imagined to consist.

In all these cases, although the object is to obtain the primary nervous shock through the sudden impression made on sensation; yet as there necessarily co-exist with this, refrigeration of the surface and repulsion of fluids to the internal parts, the secondary effect, termed re-action, is frequently an inevitable result of this application of the bath. In the cases, therefore, in which re-action is likely to prove injurious, the remedy should not be used, as it is hardly possible to avoid its occurrence; or when used, the application should be extremely short, and the body should be dried immediately. Before making trial, in any case, of a remedy so powerful, care will, of course, be taken to ascertain, as far as this is practicable, the powers of the system to sustain the shock.

II. *Refrigeration.*—When the object is to obtain the refrigeratory action of the cold bath, with as little as possible of the nervous shock or vascular re-action, it must be applied in the way least likely to produce the two last. We shall see presently that the degree of re-action is, *cæteris paribus*, proportioned to the degree of cold, if this is only temporarily applied; we have just seen that the nervous impression is proportioned to the suddenness and vehemence of the application of the water, and also to its coldness; if, then, we wish to produce the refrigeratory effect alone, we must neither apply the water of a low temperature, nor suddenly, nor forcibly.

The only cases in which refrigeration is required as a remedy, are those in which the animal temperature is elevated above the natural standard; and this happens only in febrile diseases. In symptomatic fevers, the consequence of local inflammation of the viscera, this remedy is rarely applicable; being usually, when so employed, productive of an aggravation of the disease. In the class of fevers termed idiopathic, as in the common continued fever of this country, or typhus, cold water has been extensively used, and often with benefit. In the preceding paragraph we have already noticed one mode in which this remedy has been applied, not however with the view of refrigerating the surface, but of suddenly cutting short the disease. When this latter object is not attained, the result has commonly been an increase of the febrile heat and vascular excitement. To ensure refrigeration in this and other cases, the water should be applied at first only a little below the temperature of the skin, its heat being insensibly and gradually reduced, but never below that of tepid, or at most, cool. The gentlest mode of applying it is the best, as with a soft sponge; and the process should be persevered in without interruption until the desired effect is produced. The non-interruption of the application is the more essential in proportion as its temperature is low. In local affections of an inflammatory kind, in which very cold lotions are used as a refrigerant, as in cerebral inflammations and in phlegmon, the result is frequently different from what is intended, from neglect of the precaution just mentioned. The renewed application of the cold fluid, after a temporary suspension, frequently gives rise to a series of re-actions in the part, which are calculated much more to aggravate than to relieve the disease. In such cases, if the lotion is very cold, its application ought to be uninterrupted until the intended effect is produced. If the water is of a temperature little below that of the body, the interruption of its use will have no further injurious effect than the subtraction of the amount of good which its continued application is calculated to produce.

III. *Re-action, or glow.*—The cold bath may be used, in the third place, with the view of producing its secondary effects — re-action. As this is by far the most important end for which it is employed, and as, indeed, almost the whole practical doctrines relating to cold bathing are involved in the consideration of this subject, we shall devote a considerable portion of the remainder of this part of our article to an examination of the circumstances which obstruct or favour its production.

1. The degree of re-action is, in general, *cæteris paribus*, proportioned to the coldness of the water. A very cold bath is followed by a speedy and powerful re-action; a cool bath by a slighter re-action, and after a longer interval; while a bath approaching the limits of tepid produces scarcely any re-action.

2. In general the re-action is proportioned, *cæteris paribus*, to the suddenness and also to the force with which the body is brought in contact with the bath. An instantaneous immersion produces a greater re-action than a gradual immersion; and a plunge from some height produces a greater re-action than a gentle dip, however rapidly performed. In like manner, water falling on the body from some height has a much greater effect than simple ablution with water of the same temperature.

3. Within certain limits, that is, short of the period at which healthy re-action ceases to be produced, the re-action is, in general, proportioned to the period of stay in the bath,—in other words, to the degree of refrigeration.

4. The re-action is commonly proportioned to the vigour of the circulation in general, and more particularly to that on the surface; it is likewise proportioned to the warmth of the skin and extremities previously to immersion. It is, therefore, a constant rule that persons with a feeble circulation and cold extremities must endeavour to invigorate the circulation, and increase their temperature previously to using the cold bath. To ensure the proper degree of power, it is even necessary, in some cases, to administer a warm beverage, or to take a glass of wine before entering the water; and were it always convenient, it would often be beneficial, in cases of this kind, to go into the warm bath for a few minutes before immersion in the cold.

5. Re-action is greater, *cæteris paribus*, if muscular motion is exerted in the bath, than if the patient remains in a state of repose. Swimming is therefore more tonic than simple immersion, and the large open bath admitting of motion more tonic than the common small bath. The increase of re-action from motion is partly owing to this producing a greater feeling of cold, by occasioning a quicker change of the particles in contact with the surface; but principally by the increased excitement resulting from muscular exertion. In the case of swimming, as in all others, it is always to be understood, when spoken of in relation to its power of increasing re-action, that the period of stay in the water is not prolonged beyond that suited for the production of all degrees of re-action.

6. Whatever tends to prevent the temperature of the surface from falling below the proper degree, or directly stimulates the skin, or excites the action of the heart, will proportionally increase the power of re-action. On these grounds, the speedy drying of the body on leaving the bath, strong friction of the surface or the application of heat to it, the drinking of warm fluids, or active bodily exercise, will ensure or increase re-action; while the omission of these measures, or measures of an opposite kind, will produce opposite effects.

§ 3. Of the practical administration of the cold bath, and more particularly of the salt-water bath.

Although it is certain that the most important of the effects produced by baths depend on their temperature, and on other circumstances having no relation to their chemical constitution, it will not be doubted by any practitioner of experience, who has had sufficient opportunities of comparing the effects of the bath of simple water with those of mineral waters or of the sea, that the chemical composition of the materials used in bathing is a matter of considerable importance. Without at all entering here upon the question of the powers of absorption possessed by the skin, whether of water simply applied to it or of substances dissolved in water, experience has satisfactorily proved that the effects of immersion in pure water, and in water containing salts in solution, are different. Sea-water and mineral waters, particularly such as contain sea-salt or iron in solution, are more tonic, stimulant, and bracing than simple water, and when used as a cold bath are productive of a greater re-action than the latter. When, therefore, the object is to produce re-action, and to brace the system, (and this is the object in a vast majority of the cases in which the cold bath is used,) sea-water is always to be preferred to fresh. If this cannot be procured, the water ought, when practicable, to be rendered artificially saline by the solution in it of common salt.

For these reasons, and because in the greater number of cases in which cold bathing is proper the summer temperature of the sea is exactly that most suitable,—and, moreover, because this is the form of the cold bath in most general use in this country,—we shall, in the present section, direct our attention particularly to *sea-bathing*.

1. The period of the year best adapted for sea-bathing is, of course, the summer and autumn, at which seasons the temperature of the sea on our shores varies from 55° to 70°. Bathing in the open sea may, however, be prolonged beyond the autumnal months, and even through the whole winter in particular cases. It will scarcely ever be proper to commence sea-bathing in the latter season; but many persons who have regularly used it in the summer and autumn may continue it through the severer season with great advantage. Such a recommendation presupposes the possession of a vigorous constitution, or, at least, great powers of re-action in the patient.

2. The time of the day for bathing in the open sea must depend, in many places, on the state of the tide. A slight deviation may be allowed on this account; but the particular time best adapted to the invalid must not yield to reasons of mere convenience. By the majority of persons for whom the cold bath is prescribed, either as a measure of hygeiène or as a remedy, the best time for using it will be about noon; that is, two or three hours after breakfast. At this time we may presume that the system is sufficiently recruited by the assimilation of the morning's meal; and we may yet farther be enabled to ensure re-action by such previous exercise as may be deemed pro-

per. In very hot and calm weather, the sun is, however, often too powerful at noon for delicate persons, more particularly on those parts of our southern shores which are sheltered by high cliffs. In these cases an earlier hour must be chosen, or bathing in the open sea must be given up.

When the constitution is vigorous, and the temperature of the surface is uniformly high, and when the patient rises from his bed refreshed and active, the bath may be taken early in the morning, before breakfast. This is, in general, the best time for using the cold shower-bath; and the reason why it is found to suit better at this hour than the sea-bath, probably is, that the shower-bath is taken immediately on rising, while the surface still retains all the warmth of the bed. If one could plunge into the sea as easily, and before the surface is at all chilled by dressing, &c., there is no doubt that the practice would suit very well with many with whom it is found to disagree.

In using the open sea in summer, it may be of some consequence to recollect that the temperature of the water may be very different at different times, according to the circumstances of the locality, the hour of the day, and the period of high water. If the shore consists of level sand or shingle, the tide which flows in the afternoon, over a large expanse of surface heated by the noonday sun, during the period of ebb, will often be a good many degrees higher than the morning tide in the same place.[*]

3. In using exercise previously to the bath, with the view of rendering the circulation more vigorous, according to the principles formerly stated, the invalid must be careful not to induce fatigue or much perspiration. A slight moisture on the skin (which, however, should be wiped off previously to entering the bath,) forms no objection to its use, provided the surface still continues warm and the circulation vigorous; but if the body has been for some time losing its heat by copious perspiration, and the general powers of the system have been lowered by fatigue, the cold-bath cannot be used without danger, however warm the surface still may be.

4. The mode of entering the bath, the length of time the patient remains in it, and other particulars, must be regulated according to circumstances. From what was formerly stated, the propriety of entering the bath suddenly will be seen, and likewise the necessity of leaving it while there still remains sufficient power of reaction. The advice commonly given to a patient to take at first only one or two dips to ascertain the power of re-action possessed by him, and gradually to prolong the period of stay in the water, is judicious. From five to ten minutes may be said to be a medium period for staying in. Moving the body and limbs while in the water is highly advisable, and, of course, the exercise of swimming, if the patient possesses the requisite power and skill. The body should be speedily dried, and hastily but well rubbed with a somewhat coarse towel, and the clothes put on without any unnecessary delay. In ordinary cases no further precaution will be necessary to ensure the requisite degree of reaction; but in very feeble subjects the measures formerly mentioned in reference to such cases, must be put in practice.

5. The cold bath may be repeated daily or every other day, or twice a week, according to the nature of the case, the effects of the remedy, and the state of the weather. It may be continued indefinitely and uninterruptedly, or it may be taken for a short time, omitted for a space, and then resumed. Where it is found to agree with the patient, it ought to be continued at least one month, and may be very beneficially extended to three.

6. A common and often a most injurious error in the practice of sea-bathing is, that the patient remains so long in the water that the animal heat is lowered below the proper degree. This is an error, however, more commonly committed by persons using the bath as a luxury, than by invalids. In boys of a feeble constitution or strumous habit, we are convinced that great mischief is often produced in this way, when it is least expected. The principle on which such results are explained has been ably illustrated by Dr. Edwards, in his excellent work *On the Influence of Physical Agents on Life*. It was ascertained by him, in the course of his experiments on living animals, that the temporary elevation or depression of the animal temperature, above or below the natural standard, not merely added to or subducted from the system the amount of caloric necessary to produce the effect indicated by the thermometer at the time, but modified, for some time afterwards, the activity of the calorific process itself. Animals whose temperature had been raised by artificial heat, were invariably found, on the withdrawal of this, to continue for some time to generate more heat, in the same period, than before the experiment; and those whose temperature had been lowered, to generate less. Although Dr. Edwards's experiments were confined to the inferior animals, both analogical reasoning and observation leave no doubt that the principle is equally applicable to the human subject. Every one must have had occasion to observe, and most people to experience in their own persons, the effects of a severe chill being felt long after the usual temperature has been restored. Subsequently to long exposure to cold, as in a carriage or church, when the clothing is insufficient, or when cold bathing has been improperly prolonged, a sense of chilliness often remains for days, although the body has been repeatedly and thoroughly warmed in the meantime. We have known such a state continue for two or three weeks, the individual daily expecting the invasion of some formal disease, and yet none such occurring.

The corollary from these premises is, that when the cold-bath is employed with the view of invigorating the system, it should never be so prolonged as materially to lower the animal temperature. In such cases the re-action will either be imperfect or it will be succeeded by a sense of chilliness.

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[*] The following memorandum shows the temperature of the sea at Bognor, on the coast of Sussex, in the summer and autumn of the year 1831.

On the 4th July, at mid-day, the temperature of the atmosphere being 72°, the sea was 69°.

July 12, 7 a. m. Atmosph. 63°, Sea 66°
Aug. 3, 8 p. m. Atmosph. 65°, Sea 71°.
Aug. 11, 1 p. m. Atmosph. 70°, Sea 71°.
Sept. 5, 8 a. m. Atmosph. 64°, Sea 65°.
Oct. 29, 11 a. m. Atmosph. 60°, Sea 54°.

In order to obtain the full degree of salutary re-action, and at the same time to avoid the risk of subsequent chilliness, immersion in the cold-bath should cease just before the animal temperature is sensibly diminished; and it may be deemed, for all practical purposes, a sufficient test that this point has not been passed, as long as the primary glow or reaction is felt to continue.

§ 4. Of the Temperate Bath (75° to 85°).

The effects of this bath on the system are precisely the same in kind as those of the cold-bath, but they are much less in degree. This bath, therefore, is applicable in a different class of cases, and it is also applicable in the same cases in which the cold or cool bath may be of use, but cannot be applied without some hazard. The Buxton water, which is of the temperature of 82°, is the best natural example of this class of baths. The shock produced by water at this temperature is small, and the re-action proportionally slight. As this bath may, therefore, be safely prescribed in cases where danger might be apprehended either from the too powerful shock on the nervous system, or the too great and sudden retropulsion of fluids on the internal organs, it will, for the same reason, be found much less efficacious in the cases in which the principal benefit results from a powerful re-action. It will also be frequently preferable in the case of delicate persons, and in persons of peculiar sensitiveness either of the whole system or of the skin only, in whom the shock of the very cold bath, or even the cool bath, cannot be borne; although if it could be borne, its effect in repelling the fluids could be productive of no evil. In such cases, and in others also of a somewhat different kind, a bath of this temperature will often be proper as a preparation for the use of the bath at a much lower temperature.

It is, indeed, a question often raised, whether the patient should at once commence with the bath of the full degree of coldness intended, or should at first use one of a higher temperature and gradually lower it. For instance, should a patient for whom the cool or cold bath is prescribed, begin at once with it, or previously use that which we are now considering? This point can only be fixed in individual cases. Generally speaking, if there is any doubt of the system being able to bear the shock of the cold bath, the temperate should be raised, and more particularly in the case of delicate persons and women and children, and in persons who have a dread of the effects of the bath.

It is always to be recollected, however, that if our object is to corroborate the system by producing re-action, the lower temperature is decidedly best, if it can be borne. And we are of opinion that among the vast number of cases in which the cold or cool bath is indicated, very few will be found in which it will not be borne at once. All that is necessary is, by proper management before and after the bath, and by making the immersion extremely brief, to ensure the salutary degree of re-action.

§ 5. Of the different Forms of the Cold Bath, and their particular Effects.

1. *Large and small baths — open and close baths.* The observations heretofore made may be considered as applying generally to every form of bath by immersion, whether the water is in the open sea, rivers, ponds, &c., or confined under a roof in large or small baths. It must not, however, be imagined that it is a matter of indifference to the patient under what circumstances the bath is administered. It may be stated in general terms that bathing in the open air is more advantageous than bathing under cover, and that a large bath is preferable to a small one. It is scarcely necessary to observe that when a tonic effect from the cold bath is the object, the open air, more particularly of the sea, will be much more bracing than that of a confined apartment. The size of the bath is of still greater consequence. In the common domestic bath, the patient can scarcely have the advantage of a complete and sudden immersion; and all effective motion, while in the water, is completely precluded. The importance of this deficiency will be understood from what was formerly stated on the subject of re-action: in the small bath, the degree of refrigeration is often not sufficiently balanced by a proportionate degree of this salutary process. For these and other reasons, the large baths at Matlock, Buxton, &c., are decidedly preferable to the small baths at the same places. Of all the substitutes for the open sea which we have seen, the *swimming bath* lately erected at Brighton is by far the best. From its great extent and airiness, and the constant renewal of the water, this bath certainly possesses many of the advantages of the open sea, and it has one superiority, that, namely, of being accessible in every kind of weather and at any time of the day.*

2. *The shower-bath.* — The form and general character of the shower-bath are too well known to require description. Its effects are, on the whole, similar to those of the plunge-bath of the same degree of temperature: but there are some differences between them which deserve the notice of the practitioner.

The immediate shock from the shower-bath is, in general, felt to be greater than that from simple immersion; more particularly if the quantity of water is great, its temperature low, and the fall considerable. On the other hand, owing to the absence of permanent compression of the surface by a dense medium, and perhaps, also, owing to the access of air to the skin in the case of the shower-bath, the anhelation and præcordial distress are generally less in degree and certainly less permanent than in the plunge-bath. From these and various other circumstances, individuals constantly present themselves to the practitioner who will bear the one form of bath and not the other, or who will be more benefited by the one than the other.

In certain affections of the head, and in persons predisposed to such affections, the shower-bath possesses a very decided advantage over the plunge-bath, inasmuch as the shock and refrigeration are applied directly and in the first place to the head. And in these and many other cases also, it is a great advantage possessed by this bath, that the feet may be immersed in hot water during the process. This not only tends to prevent too great a repulsion of the fluids upon the internal organs in cases where this is to be apprehended, but in feeble and sensitive persons it tends at once to lessen the shock and to increase the re-action.

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* The swimming bath at Brighton is 53 feet in diameter; its depth from 3 feet 6 inches on one side to 5 feet 6 inches on the other.

It is an important advantage possessed by the shower-bath, when properly constructed, that it can be increased or diminished in force, suspended, renewed, shortened, or prolonged, according to the feelings of the patient.[*] The small quantity of water necessary to prepare a bath of this kind is another great advantage, as giving facility for having it at any degree of heat required.

3. *Affusion, aspersion, ablution.*—These may be employed either as general or local baths. Water thrown over the naked body from a vessel is a rude form of the shower-bath, and has similar effects. By ablution, we commonly understand the process of applying water to the surface by means of a sponge or towel. When general, it differs only from the shower-bath in being attended by a lesser shock, and consequently a feebler re-action. It is much more frequently used as a partial bath, more particularly to the head and trunk of the body, in which form we consider it as one of the most valuable applications both hygeiènic and therapeutic. The daily ablution of the chest with cold water, containing vinegar or salt in solution, is one of the most effective tonics in a numerous class of diseases, and the easiest and surest remedy of that almost general and, we fear, increasing disease, a proclivity to catch cold. (See the article ASTHMA.) This form of bath is always to be used, by the delicate, in the morning, immediately on getting up, while the body still retains all the warmth of the bed, unless, indeed, there is perspiration present at this time.

The employment of cold ablution as a remedy in fever was formerly noticed. In this case, pure water should be used; in most other cases, salt water, or water rendered artificially saline, is preferable.

4. *The douse* (*dash, or douche*).—This form of bath is well known by its foreign name. It is of sufficient value to deserve an English appellation, and we venture to revive an old one, which has at least the negative advantage of being less discordant to our orthography and pronunciation than the French term.[†] The douse consists of a small stream of water directed with considerable force from a tube upon some particular part of the body. It varies in its power according to the diameter of the stream, the temperature of the water, and the force with which it is projected on the body. It is an agent of great power; but it is more employed in the domain of surgery than medicine. This is, perhaps, the most effectual of all refrigerants, owing to the incessant and rapid change of the particles of the fluid applied to the part, and also to the compression on the capillaries produced by the mechanical impulse of the stream. A homely form of the douse is the placing the affected part under the stream from the nozzle of a pump, or the spout of a tea-kettle. The chief instances of a strictly medical kind in which this form of bath is used, are to the head in cerebral diseases, and to the loins in uterine affections. In inflammatory affections of the brain, whether idiopathic or originating in fever, it is a most potent remedy. It is also in frequent use, in some parts of the continent, in mania. In all these cases it requires to be used with discrimination and great circumspection, as it is capable of producing the most powerful effects.

5. *The hip-bath, foot-bath, &c.*—There is no limit to the number of partial baths but the number of parts of the body to which water can be locally applied. The most important are the two just named. They are both very valuable remedies, and their administration is well understood. The former is principally used in diseases of the pelvic viscera; the latter chiefly as a measure of hygeiène. Children ought to be accustomed to the daily use of the cold foot-bath, as nothing tends more to prevent chilblains—a disease, however apparently slight, of really serious consequence in delicate habits.

§ 6. OF THE DISEASES IN WHICH THE COLD BATH IS EMPLOYED; AND THE CONTRA-INDICATIONS TO ITS USE.

The applications of the cold bath, both as a measure of hygeiène and as a curative agent, are numerous and important. It is, indeed, one of the most valuable remedies we possess. Like all valuable and powerful remedies, however, its employment requires great caution and discrimination, first, as to whether it should be used at all; and, secondly, as to the form and mode of using it. It must be confessed that in a vast number of cases no such discrimination is practised; and it will not be doubted by any physician resident in the vicinity of the sea, that in the case of no other remedy are greater mistakes committed and greater mischief produced than in the use of the cold bath. It is impossible, within the limits of the present article, to do more than give an outline of the numerous cases in which the cold bath is beneficial. This, however, is of the less consequence, as the practitioner who is acquainted with the mode of action of this remedy, and the general principles which ought to regulate its employment, (and we have endeavoured to explain these in the preceding pages,) will have little difficulty in applying it to individual cases.

Before entering upon the consideration of the diseases in which this remedy is proper, it will be well to give a brief statement of the particular conditions of the system, whether morbid or not, which either entirely forbid its use, or render great caution necessary in employing it.

1. The cold bath is less applicable in infancy and old age than in youth and middle life.

2. It is not admissible during the menstrual period, and only with great caution during pregnancy.

3. It is inadmissible in great plethora; in cases where there exists a predisposition or tendency to

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[*] A shower-bath should be so constructed as to contain a much greater quantity of water than is usually thought necessary, and to permit the shower to be suspended and renewed at the will of the bather. One of the most convenient forms is that which is erected over the common domestic warm bath, and which permits the patient to escape from under the stream, and to return to it at pleasure. The materials for enclosing the shower-bath ought to be of wood, as cloth or canvass, whether painted or not, retains moisture, and proves thereby injurious by occasioning dampness.

[†] The *douse*, (pronounced like *house*,) from the old neuter verb, TO DOUSE, *to fall suddenly into the water.*

active hemorrhage, to local congestions in the more important viscera, &c.; consequently in apoplectic subjects, in a tendency to hæmoptysis, &c.

4. It is improper in persons affected with disease of the heart, particularly with dilatation or valvular obstruction; and it must be used with great caution in those who, without any formal disease, have naturally a thin and feeble heart. This is often the case in strumous and phthisical habits.

5. It is generally inadmissible in indurations, obstructions, or chronic inflammations of the internal parts of the body, more particularly of the principal viscera; likewise in all acute inflammations of the same parts; and also in chronic inflammations of the mucous membranes of the bronchi and intestinal canal, except when these last are very slight.

6. It is improper in loaded states of the bowels, more particularly if these are combined with a gorged state of the venous system of the abdomen.

7. It is either inadmissible, or only to be used with great caution, in most cutaneous diseases; particularly such as are apt, when suddenly removed, to be followed by internal affections.

8. It is inadmissible in great general debility, and where there does not exist sufficient power of re-action, more especially if there exists an habitually cold state of the surface. In cases of this kind, however, the cold bath may be often advantageously employed after the previous use of the warm water or vapour bath, provided the debility is not the result of some local organic disease.

One of the most important class of cases, short of formal disease, in which the cold bath is beneficial, consists of the various forms of general debility which show themselves in childhood and youth, either as congenital constitutional peculiarities, or as the consequences of previous disease. Of the first kind, the strumous habit constitutes the most important example. In cases of this kind, when properly selected, the cold sea-bath and a residence by the sea-side are frequently of very singular benefit. Every thing, however, depends on the judicious selection of the cases, and on the proper administration of the remedy; since quite as much injury as benefit may result in this class of cases without the greatest care. In children of a strumous habit we have at the same time, in general, a feeble heart, and a very sensitive surface. Great caution is, therefore, necessary, in first administering the bath, lest the shock be too powerful for the energies of the system, and be not followed by the necessary degree of re-action. Every measure formerly mentioned as proper to ensure this result must be employed, as otherwise the bathing will be highly injurious. In most cases it will be found sufficient to take care that the circulation on the surface is as vigorous as possible previous to immersion; to make the immersion sudden and complete, and, at first, merely momentary, and to follow it up by strong general friction with flannels. In more delicate subjects it may be necessary to begin with the tepid or temperate bath, or to take some of the additional precautions formerly noticed. It is a matter of great consequence in bathing children, that they should not be terrified by the immersion, and every precaution should be taken to prevent this. A course of baths, gradually reduced from a high to a low temperature, is beneficial in this point of view, even if it were not often so likewise by improving the condition of the skin, and rendering it more susceptible of re-action. It is to be here understood that it is to the *strumous habit*, and not to the diseases of scrofulous persons, that the foregoing observations are intended to apply; as we are well convinced that there are few such diseases in which the cold bath is not injurious. Great care must therefore be taken by the practitioner, before prescribing this measure, to ascertain that there exists no local disease of consequence. We do not consider slight swelling of the external glands as a positive contra-indication of the cold bath, provided the internal organs are sound; but such appearances are always suspicious, and impose greater caution in the use of the remedy than if they did not exist.

When, in strumous habits, the system is free from visceral disease, and sufficient energy exists to produce strong re-action, the frequent repetition of this exciting and tonic process may eventually establish a permanent degree of increased activity and power throughout the whole capillary system, with an habitual development of a higher degree of temperature on the surface. Such results may be considered equivalent to a change in the very temperament of the individual; and it is certain that they are occasionally attained by the use of the cold bath, aided by suitable regimen.

In children of a feeble and delicate habit, the result of previous disease, perhaps still greater caution is requisite in prescribing the bath, as such states of general debility frequently depend on organic affections of the viscera. In this last case, the remedy is altogether improper, and cannot be administered without danger. The same remark is equally applicable to persons in more advanced life. We may add, as a general observation, that there is scarcely a more common or more injurious practical error, than this of assuming debility to be general, when it is the result of some local affection. In all cases of this kind, at whatever period of life, cold bathing is seldom beneficial, and very generally injurious. Here, as in most cases, it is to be viewed in the same light as other tonics, which may be stated as generally contra-indicated in what may be termed symptomatic debility. In place of being strengthened, such persons are certainly debilitated by the treatment, and great risk is incurred, not only of increasing the primary disease, but of producing others. It is in such cases that we observe the occurrence of bilious and febrile attacks, headachs, and other disorders, so frequently noticed as results of indiscriminate sea-bathing. Permanent headachs have been produced under such circumstances.

In cases of a debilitated and relaxed habit, free from visceral disease, from whatever cause arising, the cold bath may be considered as useful, if sufficient power of re-action exist in the system. When the skin is relaxed and flabby, and there is a great tendency to warm perspiration on slight exertion, or to cold clammy perspiration in bed, the salt bath is especially indicated. In no class of persons is this measure more beneficial than in those who inhabit a low, relaxed, damp climate, in whom debility and nervousness in various forms, and relaxation of the skin and mucous membranes, are frequent and conspicuous ailments. When combined with a more bracing climate, and dry pure air, the benefit from this measure is often most speedy and remarkable. For persons of this class, no place on the southern coast affords such advantages as Brighton, and some other places in its vicinity, where the high, airy downs come close to the sea brink.

There is one case of debility frequently met with in practice, which requires great caution in prescribing the cold bath, and where frequent mistakes are committed, for want of due discrimination: we allude to that state of debility which so often precedes the development of tubercles in the lungs, and which has been so well described by Dr. Clark, under the name of tubercular cachexy. (The Influence of Climate, &c. Lond. 1830.) If tubercles already exist in such cases, (and we know that they often do so without any external or local symptoms of their presence,) cold bathing will almost always be found to disagree, and will tend to accelerate the fatal disorder of the lungs. If only the predisposition exists, and the system still retains sufficient power of reaction, a cautious use of the cold bath may prove extremely beneficial; but in no case is more care requisite to ensure reaction, without which the measure cannot fail to be highly injurious.

As a preventive of the numerous diseases produced by cold, or rather by the variations of temperature, the cold bath, in one or other of its forms, excels all other measures. In the numerous family of catarrhal disorders, it is almost the only preventive of value; and frequently it is here of extreme value. It obviously acts in various ways in warding off these diseases. In the first place, it acts as a tonic to the whole system, thereby rendering it less easily affected by deleterious influences from without. Secondly, it strengthens, in a peculiar manner, the skin and the mucous membranes of the air passages, on which parts the morbific impressions producing catarrh are generally made. In the third place, by accustoming the surface to a frequent change of temperature, it renders it less liable to suffer from those which are unavoidable, and which are known to be the common causes of colds. The same observations apply, in a great measure, to rheumatism, chilblains, and other diseases produced by the same class of causes.

When used with the view of preventing these diseases, the bath, in some form, ought to be prolonged through the different seasons. In the summer sea-bathing will be best, and, afterwards, the shower-bath, or ablution. In most cases it will be found sufficient to employ the latter partially to the chest and trunk, after the weather has become cold; and it should be continued through the whole winter.

The cold bath may be said to be applicable to the whole class of nervous diseases, properly so called,—that is, diseases which manifest themselves chiefly by morbid mobility or excitability of the nervous function, and irregular action of the muscular system,—provided there exists no considerable physical change or obstruction, as it is commonly called, in any important viscus, and provided the first impression of the remedy is not found too powerful, either as an exciting or depressing agent. It is, however, more generally useful in those slighter, anomalous, nervous affections, so constantly met with in practice and under such varieties of form, than in the more formal and well-marked diseases which are alone treated of in our systems of medicine; although it is a valuable remedy in many of the latter class, when none of the contra-indications above noticed exist against its use, and when it is applied in the mode and form best suited to the individual case. Of this kind are chorea, hysteria, some cases of epilepsy, loss or depravation of certain functions, as loss of voice, smell, taste, &c.; certain forms of hypochondriasis; local paralytic affections unconnected with cerebral disease, such as loss of power in the sphincters of the bladder or anus; certain cases of palsy of long standing, in which all active cerebral affection has been removed, &c. In some of these cases the remedy is frequently only of doubtful utility, and must therefore be administered with great caution. The chief circumstances which contra-indicate its employment in such cases, are the existence of organic disease in the brain or spinal marrow, or a disposition to cerebral congestion. In all such cases, and wherever any doubt exists as to the propriety of the remedy, the shower-bath is the preferable form; and this is the only form which should be used in any case of epilepsy.

The cold bath is beneficial in many chronic affections of the mucous membranes attended with discharges, such as leucorrhœa, gonorrhœa, &c.; also in certain cases of chronic catarrh, attended with little or no inflammation of the bronchial membrane, particularly in the dry catarrh, and in those forms which seem to depend rather on a relaxed than an irritated state of the bronchial membrane.

It is occasionally beneficial in cases of passive hemorrhage, particularly epistaxis and menorrhagia.

It is sometimes usefully employed in cases of nervous or functional dyspepsia, unaccompanied with inflammation of the gastro-intestinal membrane, more particularly after a course of warm bathing. Its employment in mania was formerly noticed.

For the use of the cold bath in febrile diseases, we refer to the article Fever. We would only here repeat, what was said in a former section, that the tepid or cool ablution is the form most adapted to such cases.

The cold bath is useful in certain cases of amenorrhœa, particularly where there exists neither a very plethoric state of the habit, nor yet chlorotic debility. In chlorosis, properly so called, cold bathing is rarely admissible.

In no disease is the cold bath more beneficial than in the intervals of asthma, when the system is otherwise in a proper state for the remedy. In this case its principal action is, no doubt, as a preventive of catarrh or cold, which is by far the most frequent exciting cause of the disease. It also operates by giving tone to the nervous system, and rendering it the less susceptible of morbid impressions. (See Asthma.) On the same principles it is beneficial in the latter stages of hooping-cough. It is likewise useful in the intervals of ague, when the disease exists in a simple state, uncomplicated with any visceral affection.

OF WARM BATHING.

§1. Of the phenomena and operation of Warm Baths in general.

The only forms of the warm bath which it is our intention to notice in the present article, are, the water, vapour, and air bath. As these are respectively productive of effects sufficiently different to entitle them to be regarded as distinct medical agents, we shall treat of them separately; but as they all agree in some important particulars, it will save repetition to notice these, in the first place, under one general head. This we shall do in the present section.

The immediate action of the warm bath on the system is, like the sensations excited by it, in many respects the reverse of that of the cold bath. In the latter, nature seems to encounter a hostile power, which she must overcome before she can make it minister to her comfort; the pleasurable feelings thence resulting being derived rather from the operations of the system itself, than from any impressions communicated to it from without. The warm bath, on the contrary, is directly gratifying to the feelings, and seems at once acknowledged as a power friendly to life. In the new medium, the surface and extreme parts seem to partake of that animating sense of heat which is, in general, confined to the trunk and central parts of the body.

The following are some of the principal modes in which the warm bath affects the animal body.

1. It acts directly, and in a way altogether incomprehensible to us, on the nervous system; partly, no doubt, by modifying sensation, but also by producing effects which seem unconnected with any such modification. Its effects vary considerably with the medium, but more particularly with the degree of heat communicated. When the temperature of the bath is confined within certain limits,—as for instance, when the water bath is of the temperature of 95°, 96°, or 97°, the whole nervous system is, in general, soothed, the feelings are gratified, and a gentle languor steals over the mind. Slight degrees of local irritation, pain, or spasm, that may be present, are frequently removed, and even, in some cases, great general irritability of the system is effectually subdued, at least during the continuance of the bath. At a temperature somewhat higher than this, the bodily and mental feelings are still gratified, but a very brief continuance of the remedy produces excitement in place of tranquillity. If the heat is considerably greater, the feelings are painfully excited, and the temporary stimulus is followed by a proportionate degree of exhaustion.

2. The warm bath influences the system by elevating the temperature either of the whole body or a part of it. If the parts which come in immediate contact with the heating medium are below the general temperature of the body, they will be gradually raised to this temperature, if the bath is continued. If the heating medium is of a temperature greatly above that of the body, it will raise the superficial parts, and even the whole mass of blood, above their ordinary degree of heat. The extent of this elevation, however, as is well known, is confined within very narrow limits by that wonderful power of the living body which regulates its temperature, in a very considerable degree, independently of all external influence. While life remains, we can neither greatly elevate nor greatly depress the general temperature of the body by any degree of heat or cold applied to it. This conservative power, however, does not confer a complete immunity from the operation of the ordinary laws that regulate the distribution of caloric in inanimate matter. A great and long continued degree of cold sensibly depresses the animal temperature even of warm-blooded animals, at least in the external parts; and a great and long continued heat raises it in like manner.

The degree of heat which can be borne by the living body, as communicated by different media, varies extremely. The variation depends upon several circumstances in the nature of the heating medium, more particularly on its density, its capacity for caloric, its conducting power, the degree of fixedness or mobility of its particles, &c. Thus, the heating power of dry air is much less than that of moist air at the same temperature; this is much less than air loaded with vesicular vapour, as in the instance of the vapour bath; and this, in its turn, is greatly less than the common fluid or water bath.

3. The warm bath modifies very considerably the functions of the skin, as an exhalent and absorbent organ. We must refer to the writers on physiology, and more especially to the work of Dr. Edwards, (De l'Influence des Agens Physiques sur la Vie. Paris, 1824,) for the full exposition of this important effect of the bath. We can only, in this place, refer to the principal points which seem to be established.

a. In the state of health, the skin appears both to exhale and to absorb fluids in the water bath. The relative amount of the two processes appears to vary considerably with the temperature. At very low temperatures, and up to about 50° Fahr., absorption by the skin exceeds transudation. From this point to about 70°, the two processes would seem to be pretty equally balanced. Above this degree the transudation exceeds absorption, and the excess progressively increases with the temperature.

b. The temperature of the bath, or rather the degree of heat communicated to the body, being the same, and other things being equal, the degree of absorption is proportioned to the density of the fluid in which the body is immersed. Much more fluid is, therefore, absorbed in the water bath than in the vapour bath. It is not ascertained that the amount of exhalation is in the inverse ratio of the density of the fluid; on the contrary, there are strong grounds for believing that this is not the case: it is, however, ascertained that in the vapour bath the transudation exceeds the absorption.

c. In the warm air-bath the difference between the two processes is at the maximum, since the transudation is often extremely copious, while absorption is almost of necessity null from the absence of the material to be absorbed.

There is reason to believe that the absorbent and exhalent functions are modified in other ways by the chemical composition of the bath. But the whole subject stands in need of further investigation.

4. The warm bath modifies the texture of the skin; at least the bath of water and watery vapour. This effect arises partly from imbibition, and partly from a specific action on the animal fibre. It is greatly less on living bodies than on those which have become dead; but still it is conspicuously marked in them. The ultimate effect is to soften, to expand, and to relax the parts with which the fluid is in contact; and it would appear that its relaxant influence extends to parts with which it is only mediately in contact. After immersion in the warm bath, for a considerable time, not merely the muscles of the limbs, but even the abdominal viscera appear to have lost a portion of their solidity and tension. Much of the relaxing property of the warm bath on the surface of the body is no doubt derived from the temperature; as we know that the cold bath has, in a considerable degree, the very reverse operation. Yet a good deal must be attributed to the effect of the water independently of the temperature, since we find. firstly, that even cold water, if long applied, produces a softened state of the skin; and, secondly, that dry heat, or heat conveyed through the medium of air, does not produce similar effects.

5. The warm bath modifies the frequency and force of the action of the heart. This is sufficiently shown by its well-known effects on the pulse. The precise effects of the bath in this way depend on many circumstances, some having reference to the patient, and some to the bath. In general it may be said that when the degree of heat communicated is moderate, and the sensibility and irritability of the subject are not excessive, the change produced in the frequency of the pulse is not remarkable. If the medium is water, and the temperature does not exceed 97°, although the pulse and respiration may be slightly quickened upon the patient first entering the bath, yet after a short time, when the surface and extremities have become moderately but thoroughly warmed, and the nervous system *accustomed*, as it were, to the new stimulus, the heart and lungs resume nearly their natural action. The pulse may be somewhat fuller, but, in general, is not increased in frequency. When the temperature is raised to the full heat of the blood (98°), it will, in most cases, slightly augment the power and frequency of the heart's action. At still higher temperatures, the pulse becomes considerably increased in frequency, and in a degree proportioned to the temperature; and if this is carried to the highest point at which it can be sustained, the frequency becomes extreme.* When so much excited, the pulse occasionally continues quick for several hours after the bath, and in some cases it does not regain its natural standard, until after the patient has had a night's rest.

6. The warm bath modifies the relative distribution of blood throughout the system; more especially the relative proportion of this in the external and internal parts. When a disproportionate quantity exists in the internal organs, the warm bath recals it to the surface, and in various ways: 1stly, by exciting the superficial capillaries to increased action; 2dly, by relaxing and dilating the external tissues, so as to render them not merely capable of containing more fluid, but to force them, by a physical necessity, to draw an additional supply from other parts; 3dly, by directly relieving the local irritation on which the internal congestion may depend.

It is to be observed, however, that this equalizing power of the warm bath only exists when the temperature is of that moderate degree which does not excite the heart to preternatural action. If the stimulus of the heat augments the force and frequency of the heart's contractions considerably beyond the standard of health, although much more blood than before may be attracted to the surface, the internal parts are not unloaded in the same proportion. On the contrary, the whole vascular system being stimulated to increased action, and the contained fluids being in some degree dilated by the increase of the temperature, an increased quantity of blood is thrown into the capillaries (at least in the same space of time) in every part of the body.

7. The warm bath increases the volume of the superficial parts of the body and of the general mass of circulating fluids, in proportion to the degree of temperature communicated to the system. This effect is obvious on the surface generally, and is demonstrated in parts capable of admeasurement. Rings on the fingers, which we had occasion to notice as becoming loose in the cold bath, in the warm bath fit more tightly, the soft parts on both sides frequently swelling considerably beyond the diameter of the ring. The same thing is shown by the greater difficulty of putting on tight shoes after the warm bath. Some physiologists attribute the principal results observed in the applications of the *hot bath* to the expansion of the fluids. No doubt it must have a certain effect, but by no means to the extent which has been supposed. The effect of heat as a stimulus exciting the heart to increased action, and thereby throwing the blood with greater force and rapidity through the whole vascular system, is of much greater consequence than its physical dilatation. It must be recollected that the universal and intimate penetration by the blood of all the solid tissues will soon raise them to the same temperature as this fluid, and, expanding them proportionally, will remove the evils that might arise from an over-distension caused by a disproportion between the vessels and their contents.†

§ 2. Of the Warm Bath, strictly so called, (water from 92° to 98°.)

The general effects of the warm bath have been mostly noticed in the last section; but we shall give a brief recapitulation of them here, for the convenience of practical reference. The warm bath possesses at once the somewhat opposite powers of exciting and soothing the nervous and vascular systems. Its power of soothing the nervous system is direct and obvious; its power of exciting is, in general, confined within the limits of natural or healthy action. It may be said rather to prompt to normal action than to excite. It acts as a direct but gentle stimulus to the skin, augmenting the quantity of its blood, and at the same time relaxing its texture. It produces a more general and equable distribution of blood throughout the whole system; and, in a more especial manner, *derives* it from the internal parts to the surface and extremities, without, at the same time, giving rise to undue action or irregular determinations to particular parts. By these various actions it universally promotes absorption and re-action. Its ultimate effects are to soothe and refresh the whole system, and, at the same time, to render all its functions freer and of more ready performance. When its operation is prolonged, the soothing and relaxing effects become progressively more and more predominant, while the gentle excitement proportionally decreases. By these various modes of influencing the system, it is capable of fulfilling various indications in the treatment of diseases, according to the mode of its application, and the particular state of the system at the time. By relieving pain and irritation, it acts as a sedative; by restoring deranged functions, and rendering them of more ready performance, it acts, like the cold bath, as an indirect tonic. By its soothing effect on the nervous system, and its general powers of relaxing, it is an antispasmodic. By modifying the circulation in the extreme parts, it is strongly derivative; by its action on the skin, it is directly diaphoretic; and by more or fewer of these modes of action combined, it becomes a powerful alterative. It acts in several other ways, to which it is not easy to give a formal designation, but which will be understood from what has been stated in the preceding section, and what we are now about to deliver.

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* See the experiments of Dr. Parr in his Thesis de Balneo, *Edin.* 1773, and in his Medical Dict. Art. *Balneum*; of Fordyce, Blagden, and Dobson in Philos. Trans. vol. lxv p. 111, 463, 484; of Delaroche and Berger, Journ. de Physique, tomes 63, 71, 77; of Rostan, Dict. de Méd. t. ii. Art. *Bain*.

† Is it probable that the impossibility of distension of the brain, within the solid cranium, is one reason why the effects of baths of very high temperature are particularly felt in the head?

Medical uses of the warm bath.—In treating of the employment of the warm bath, it has been customary to consider it under two heads, as hygeiènic and therapeutic, or preventive and curative. As, however, the bath is never necessary in the state of perfect health, and as most of the conditions of the body in which it has been recommended, are, in fact, deviations from this standard, and therefore, in strictness of language, morbid, although perhaps not formally designated as diseases—it is obvious that this classification is not quite accurate. We shall, nevertheless, so far comply with the customary arrangement as to notice, in the first place, the milder forms of disorder; and secondly, the more formal diseases.

I. The following are a few of the cases of milder disorder, in which the warm bath is highly beneficial:—

1. In fatigue after great muscular exertion, particularly if long continued, as from fencing, boxing, hard walking or riding, playing at any laborious game, as cricket, racket, &c. In these cases, the body should be allowed time to cool before the bath is taken, and the temperature of this should not be higher than is absolutely necessary to produce the desired effects. In general, 94°, 95°, or 96° will be sufficiently high.

2. After a long journey, more particularly in the case of persons of a delicate or feverish habit. Travelling for several successive days, even in the easiest carriage and on the best roads, produces, in almost every person, dryness of skin, irregular distribution of blood, defective secretion and excretion, general irritation of the nervous system, and a slight degree of feverish heat. In irritable subjects, and still more in persons affected with some chronic inflammation, or tendency to such, the excitement from travelling often leads to serious consequences if not speedily allayed. In such cases the warm bath is an invaluable remedy; and, when combined with repose and abstinence, and a gentle aperient, may be regarded as almost specific for safe travelling.

3. In sedentariness from any cause. Also after long-continued mental excitement and loss of sleep, whether accompanied by sedentariness and seclusion, and inactivity of the external senses, as in the labours of the study; or with bodily exertion and activity of the external senses, as in many departments of public and professional life, or in the no less laborious avocations of fashionable dissipation.

4. The warm bath is very beneficial in numerous other slight disorders of the system, from whatever cause arising, and whether of a chronic kind, or the harbingers of acute diseases. Of this sort are irregular determinations of blood, particularly congestions in the internal organs, and recession of it from the surface and extremities; nervous irritations of all kinds, and disposition to spasmodic affections; a dry and harsh state of the skin, either with a disposition to feverishness, or with coldness of the surface; the reverse state of relaxation of the skin, with a disposition to clamminess and cold perspiration, &c. &c.

II. The warm bath is beneficially employed in numerous diseases of a more formal and serious kind, and of very different characters. We can only refer to some of those in which it is most useful:—

1. Chronic nervous diseases of a spasmodic kind, unaccompanied by a plethoric state of the system, or by fever, and not dependent on an inflammatory condition of the nervous centres. Of this kind are cramps, spasms, convulsions of various kinds, and particularly the convulsive affections of infants, whether depending upon idiopathic or sympathetic irritation of the nervous system. The last-named qualifications must be strictly attended to, otherwise the bath may be productive of great mischief, as we have reason to know that it often is from such neglect. We shall have occasion to notice the cautions necessary in such cases hereafter.

2. Various painful affections, chiefly of a nervous or spasmodic nature, occurring in spare habits, and without inflammation, or with a degree extremely disproportioned to the severity of the pain. Of this kind are the numerous forms of neuralgia, including sciatica and lumbago, gastralgia, and colic; also gall-stone, nephralgia, stone in the ureter, bladder, urethra, &c.

3. Certain acute inflammations, more espe-

cially of the mucous membranes of the abdominal and pelvic viscera, when accompanied by great pain. Of this kind are certain forms of enteritis, gastritis, inflammations excited by and accompanying gall-stone and urinary calculi; some forms of dysentery, diarrhœa, cystitis, hysteritis, &c. In all these cases, or with very rare exceptions, previous loss of blood, both generally and locally, will be necessary to constitute the bath a useful, or even a safe remedy. With such preparation, however, and if not contra-indicated by the plethoric habit of the patient, or other circumstances, the bath, at a temperature not exceeding 97°, is often extremely beneficial.

In the class of cases now under consideration, a great mistake is frequently committed by the practitioner overlooking the inflammations which accompany the pain and spasm, and prescribing at once opium and the warm bath, without any attempt to lessen, previously, the violence of the local affection, or the general fever, by proper depletion. In instances of this sort, the bath, more especially if administered at a high temperature, as it often is, has a direct tendency to aggravate in place of relieving the disease.

4. Certain chronic inflammations, congestions, or irritations of several of the same parts, not essentially of a painful kind. Of this sort is that extensive class of diseases of the intestinal mucous membrane, commonly arranged by French writers under the general name of chronic *gastro-enteritis*, and indicated in different cases by the common symptoms of dyspepsia, constipation, diarrhœa, &c.; also chronic inflammations or irritations of the uterus, vagina, bladder, kidney;—dysmenorrhœa, dysury, amenorrhœa, leucorrhœa, &c. In most of these cases local bleeding will be proper previously to the administration of the bath; and in several of the affections of the pelvic viscera, the hip-bath will frequently be preferable to the general bath.

In no class of cases is the warm bath more strikingly beneficial than in those affections of the stomach and bowels which are commonly ranged under the head of *dyspepsia*. This remark is more especially applicable to the forms of this affection in which there co-exist a fixed local irritation in some part of the bowel, an unhealthy state of the skin, and an irregular distribution of the blood, more particularly on the surface and extremities. And we may add that there are few if any cases of dyspepsia, of long standing, in which one or more of these states do exist. It is well known that the skin has a much more intimate sympathy with the mucous membranes than with the parenchymatous viscera; and this truth is in no case more strongly manifested than in the effect produced by the warm bath in affections of the gastro-intestinal membrane. Besides its direct effect in this way, through the medium of the nervous system, it acts at the same time locally on the skin as a powerful derivative, and as a means of equalizing the circulation in the central and extreme parts. A sensible remark, made by M. Rapou, in speaking of the effect of the vapour-bath in this disease, is equally applicable to the warm bath. He says, that chronic inflammations of the mucous membrane of the stomach and bowels are frequently confounded with diseases of a very different kind, such as nervous dyspepsia, gastralgia, &c. In cases of the last-mentioned kind, antispasmodics, bitters, tonics, &c., will often be beneficial; while they will be extremely injurious in the former,—the irritation of the membrane being thereby frequently excited to inflammation; or, if this already exists, it will be greatly aggravated. In both classes of cases the warm bath is at least a safe application; and, with very few exceptions, it is a most salutary one. Its administration is therefore not affected by error in diagnosis. We may add that it is in the very cases where internal remedies are most prejudicial, that the warm bath is most beneficial; namely, in irritated states of the mucous membrane, accompanied either with obstinate costiveness or a tendency to diarrhœa, or the one alternating with the other. From its action in such cases, the warm bath may be said to be at once laxative and astringent; and when its use is combined with proper diet and exercise, or, at most, with a few leeches to the præcordia or anus, cures will often be effected by it, in cases of long standing, with little or no aid from medicine. *Cæteris paribus*, the warm bath is the more indicated in dyspepsia the more the surface deviates from the healthy state, whether in regard to the distribution of the blood in it, or to its functions as a secreting and excreting organ.

5. The warm bath is beneficial in various chronic diseases of a general and cachectic kind, attended by great functional derangements of important organs, and generally by a depraved state of the blood, as well as an irregular distribution of it. Of this kind are gout, general disorder of the system from long-protracted dyspepsia and loaded bowels, diabetes, chlorosis, &c. &c.

Few questions were formerly more agitated among medical men than the propriety of warm bathing in gout, and more particularly of the warm waters of Bath. The zeal with which the question was regarded has, however, greatly lessened in our time; partly because longer experience has tended to solve it more satisfactorily, and partly because some progress has been made in ascertaining the pathology of gout. Diseases in general, and this among the rest, are not now treated on principles so completely empirical as formerly.

In viewing gout in relation to its treatment by warm bathing, we may, in a great degree, although not entirely, dismiss from our minds its specific nature, and prescribe the bath on the same principles as in other diseases. In the great majority of cases, we consider it as totally inadmissible in the inflammatory stage of gout. In the intervals of the disease it is extremely applicable to many of the functional and other derangements that complicate it, or constitute an important part of it; but the propriety of its administration in individual cases must entirely depend on the particular state or degree of these derangements, or on other states of the system with which they may be combined. The great objection to the use of the warm bath in gout is the state of general plethora with which this disease is so constantly connected. It is chiefly the absence of plethora which permits the bath to exert its beneficial effects in many other diseases of a still more inflammatory nature than gout; and if we have removed this condition effectually in gout, the presence of some inflammation in the joints is not a necessary contra-indication to its use. In the general state of disorder in which gout originates, viewed abstractedly from the accompanying plethora, there is no single remedy more valuable than the warm bath; in the intervals of gout, therefore, after proper depletion, we recommend its use in the strongest manner.

6. The warm bath is useful in many chronic diseases of the external subcutaneous textures, with or without general disorder of the system. Of this kind are chronic rheumatism, the local sequelæ of gout, nodosity and other chronic affections of the joints, partial paralytic affections, muscular contractions, &c. In many of these cases the local bath, in the form of *douse* or vapour, is preferable to the general warm bath, more particularly when combined with the operations of friction, champooing, &c.*

7. A great number as well as a great variety of chronic diseases of the skin, both idiopathic and sympathetic, are greatly benefited by the warm bath in one or other of its forms. In such cases the bath acts directly as a topical remedy modifying the actual state of the skin, as well as a means of improving the general health and the internal disorders with which the cutaneous disease may be connected. This is the class of cases in which impregnation of the water with various saline or vegetable matters dissolved or diffused in it, is more especially useful, and in which the stay in the bath may be prolonged much beyond the usual period. When not otherwise contra-indicated, it may be extended to two or more hours.

9. The warm bath has been used, more particularly on the continent, in the cold stage of severe fevers, and in the retrocession or imperfect development of some acute exanthemata. In such cases, it is employed with the view of at once stimulating the skin topically, and deriving from the internal organs. The employment of the remedy, however, in such cases requires great discrimination, and we think it necessary to caution the young practitioner against its general use. In fevers of long standing, marked by much nervous irritation, harsh dry skin, &c., the warm bath of a low temperature—or the tepid bath—is very beneficial.

Many other diseases may be mentioned in which the warm bath is occasionally found to be a very valuable remedy; but we cannot here take notice of all such cases. We trust that enough has been stated to guide the inexperienced practitioner to a safe application of the remedy in most instances that may present themselves.

Cautions and contra-indications in the use of the warm bath.—There are few remedies more frequently misapplied than the warm bath, or whose misapplication is of more serious ill-consequence. It cannot be expected that we should here enumerate all the cases in which it may be misapplied, or all the cautions that are requisite in prescribing it. These must, in a great measure, be derived from the general principles that regulate its administration; but every practical physician must be well aware how frequently the principles must be modified in their application to individual cases.

The warm bath is either altogether contra-indicated in the following cases, or is not to be employed without great caution or previous preparation:—

1. In very gross, full habits; in plethora of all kinds, in great obesity.

2. In persons predisposed to apoplexy or determination of blood to the head, hemorrhage, particularly hæmoptysis. It is equally improper in most organic diseases of the heart and great vessels; and, in general, in all cases, in which the excitement of the circulation or expansion of the fluids is likely to prove injurious. In these cases the risk, generally speaking, may be said to be proportioned to the heat of the bath; and we are far from asserting that a bath of a moderate temperature may not be safely administered, under proper restrictions, in many of the diseases now alluded to. Previous depletion, as we had formerly occasion to observe, will often enable us to use the bath of a moderate temperature in inflammatory diseases, more particularly such as are accompanied with pain, or have their seat in the mucous membranes.

3. In great relaxation of the system, with a tendency to dropsy. In cases of this kind the tepid bath, however, will often be useful.

4. In extreme sensitiveness of the surface, and in persons in whom the pressure of the water occasions great precordial distress. In these cases the vapour bath is often well borne and is very beneficial. A little management will often get over the difficulties mentioned in this paragraph.

5. In all febrile diseases, whether accompanied with visceral inflammations or not, where there is an active circulation and a hot dry skin.

6. During the presence of the catamenia, except in cases of great urgency. The warm bath may be used in pregnancy, more particularly in the early months, but not without considerable caution. The contra-indications to its use must be found in individual cases; but it may be stated generally that pregnancy, in relation to the warm bath, is to be viewed as a state of excitement, if not as an inflammatory disease.

Many other grounds for its cautious employment, and also for its total prohibition, have been noticed in the preceding pages; to these and to the principles on which the general administration of the remedy is founded, we refer the reader. We would here only add one important rule which should never be lost sight of in prescribing the warm bath, or, indeed, any other powerful remedy—and this is, never to recommend it in any disease without proper examination of the individual case. Much practical mischief is the consequence of neglecting this cardinal canon of therapeutics. Examples of this truth might be drawn from most diseases in which the warm bath is used. Thus we have stated that it is a most valuable remedy in chronic dyspepsia, gout, &c.

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* In many cases of this kind the local bath invented by Dr. Blegborough, and termed by him the *air-pump vapour-bath*, is extremely useful. This apparatus combines the advantages of dry cupping with the stimulant or relaxing effects of the vapour bath. See Facts and Observations respecting the Air-pump Vapour-bath. By R. Blegborough, M. D. *Lond.* 1803.

&c., but it is so only provided there exists no active inflammation, general plethora, or other analogous complications. In many of these cases the bath will be found extremely beneficial after loss of blood, purging, or low diet; although before these were had recourse to, it might have been not merely useless but very injurious. Infantile convulsions occur to us as another case in point. Generally speaking, the warm bath is extremely beneficial in this class of diseases; but it is found to be sometimes no less prejudicial, when applied without due examination of the peculiarities of individual cases. In plethoric and gross children, a very considerable proportion, the local abstraction of blood from the head, and the complete unloading of the alimentary canal, are often necessary to render such a measure beneficial, or even free from danger.

Practical administration of the warm bath.—Under this head we shall embody various important points which require particular attention in using the warm bath as a therapeutic agent, and with which, therefore, the practitioner ought to be well acquainted.

1. *Temperature of the water.*—The exact degree of heat, between the limits 92° and 98°, that is to be prescribed, must be regulated by the peculiarities of individual cases. In certain states of disease, and in particular constitutions, the same degree of temperature will be productive of very different effects on the feelings of the patient and on the system at large. It may be stated as a general rule, not however without many exceptions, that any degree of temperature may be selected between 93° and 97°, which is most agreeable to the feelings of the patient. Many persons will prefer a higher temperature than the last named degree, but few lower than the first. If the patient's feelings require it, and there is no particular contra-indication in the case, the temperature of 98° may be allowed; but we must on no account go above this, if our object is to refresh and soothe, not to stimulate and exhaust. The temperature of 95° or 96° is, on the whole, that which is most generally pleasant and beneficial at the same time; and if either of these is found sufficiently high to maintain the feelings of comfortable warmth, through the whole period of the bath, the temperature must not be raised. If a lower temperature, however, is found more agreeable, this may, in most cases, be allowed at the will of the patient.

Generally speaking, in the warm water bath, the same degree of temperature must be kept up during the whole period of immersion; and this will easily be effected by the addition of a small quantity of hot water about a quarter of an hour after the patient has been in the bath.* The temperature must always be ascertained by the thermometer in the first instance; and the subsequent additions of water are to be regulated by its indications, and not by the feelings of the patient. Great mistakes are often committed through neglect of this rule, the temperature being gradually and imperceptibly raised much above that of the warm bath, with the entire frustration of the objects with which the remedy is prescribed.

2. *Period of stay in the bath.*—The time of the immersion, like the temperature, must be determined by the practitioner in each case, according to the nature of the disease, the constitution of the patient, and the object for which the bath is prescribed. Speaking generally, a quarter of an hour may be said to be the shortest period, an hour the longest, and twenty-five minutes to half an hour the medium. Periods greatly longer than these, however, are very common, more particularly on the continent, and are, no doubt, very proper and useful in certain cases. In the mineral water baths at different places in Germany and Switzerland, persons are accustomed to continue several hours consecutively in the bath, and even repeat the immersion after a short interval, so as to remain in the water eight, ten, and even twelve hours in the course of one day. The effects of the bath are, in all cases, greatly modified by the length of the immersion. It may be stated as a proposition generally true, that the bath, at the temperatures now under consideration, is more *relaxant* and *deobstruent* the longer it is continued. If at all approaching the temperature of the blood, it has always some stimulant effect at first, and it is only after this has completely subsided, that the relaxing effects are fully experienced. For this reason the same bath may be exciting if continued only ten or fifteen minutes, and soothing and relaxing if continued twice or thrice as long. It is not merely in cutaneous diseases, in which one of the principal objects is to produce a decided change in the affected parts by the local action of the fluid, that the immersion for several consecutive hours is recommended; the same practice is capable of producing very beneficial results in various chronic diseases of the internal organs. The least consideration of the subject, independently of experience, must lead to the conclusion, that an action of this kind, kept up for so long a time on the whole cutaneous surface, must have a powerful effect as a revulsive, and occasion important changes in the condition of the internal organs. We are of opinion that this mode of employing the warm bath is too little practised in this country. It can only be conveniently obtained at thermal springs, where alone large bodies of water of the proper temperature are always to be had, and where alone, consequently, the large or plunge bath of this temperature is to be found. So prolonged a stay in the common solitary bath would be altogether intolerable. Admirable opportunities for this kind of bathing are, however, afforded by the large mineral baths at Bath in this country, and at many places on the continent. The *Queen's Bath*, or the *Cross Bath*, at the former place, is exactly suited to the purposes now contemplated, being of the temperature best adapted to effect them, namely, from 94° to 96°.

3. *Time of using the bath.*—This, like the preceding circumstances, cannot be absolutely fixed. When prescribed in acute diseases, the bath must,

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* Considerable difference is observed in the rapidity with which the warm bath cools; dependent on the materials and construction of the bath, its size, the circumstance of the same bath having been previously used or not, the temperature of the bather's body generally, the degree of motion kept up in the water, &c. &c. The only safe mode of regulating the temperature is by keeping a thermometer constantly in the water, to be observed from time to time by the patient or attendant.

of course, be employed at any time when needed. In chronic diseases, or when used as a measure of hygeiène, the hour of bathing may be fixed. It is the practice at Bath, and some other mineral springs, to bathe early in the morning; but we apprehend this practice is adopted as much from motives of convenience as because this time is deemed preferable. On the contrary, we should say, as a general rule, that the best time for bathing is between breakfast and dinner, either two or three hours after breakfast, or an hour and a half before dinner. The latter period has this advantage, that the patient is less tempted to expose himself to the open air after the bath.

4. *The conduct of the patient* while in the bath, as also previously to its use and afterwards, deserves some notice, although this is of less moment, perhaps, than in the case of the cold bath. It is proper to enter the bath in as tranquil a state, both of body and mind, as possible. The patient, therefore, must not bathe while greatly heated with exercise or stimulated by a recent meal, more particularly after drinking much wine. A state of chilliness or coldness forms no objection to the bath.

While in the bath, the whole body should be covered with the water, or rather the parts that have been once immersed should not be left exposed to the air. Friction, with a coarse cloth or with the flesh-brush is generally to be recommended. In the large baths which admit of locomotion, this will, as a matter of course, be used, and should be used.

After the bath, the patient should not unnecessarily expose himself to the open air for some time, especially if the weather be cold; and it may be stated as a good rule for him to remain quietly in the house for an hour after the bath. It is not, however, intended to be asserted that there is, in general, much, or indeed any risk in the patient going abroad immediately on coming out of the bath: on the contrary we believe that there is much less risk of catching cold immediately on coming out of the bath than afterwards; and, except in the case of very delicate or diseased persons, there is no objection to the patient walking from the bath to his own home, if at no great distance. We, however, consider it better that no unnecessary exposure or considerable bodily exercise should be taken for an hour or two after bathing, for the same reasons that we deem them improper after blood-letting or any other important therapeutic operation. When one of the objects of the bath is to excite much sensible perspiration, it will be proper for the patient to go to a warm bed after it, to place himself between blankets, and remain there as long as the perspiration continues. When the object is not to excite perspiration, the patient should not go to bed, but dress himself in his ordinary clothing. It is a slight circumstance, but one deserving notice in this place, because of some consequence, and often neglected, that the towels used for drying the body should be always warmed, and, of course, thoroughly dry.

5. *Repetition of the bath.*—The frequency of repetition of the bath, like the other circumstances connected with its exhibition, must be regulated by the exigencies of individual cases. One bath daily is the maximum of frequency, (except in certain cases formerly noticed;) once a week, the minimum. The most usual, and upon the whole the best rule is—to take the bath every second day, or, at least, every third day. The length of time that a course of warm bathing is to be continued cannot be at all fixed, except in individual cases; and then only by observing the effects of the remedy.

6 *Form of the bath.*—The special mode of applying the warm bath is not a matter of indifference. It is true that, in a great majority of cases, the common small bath, in which the patient is immersed in the semi-recumbent posture, answers every purpose for which the bath is administered. In some cases, however, more particularly where the immersion is greatly prolonged, the constrained position in which this bath is taken cannot be borne. In such instances the large open bath, which admits of locomotion, is greatly to be preferred. Even independently of the relief from the uneasiness of a constrained position, there are many cases in which the free movements permitted in the large bath are directly beneficial. Of this kind are local affections of the limbs and joints, in which the contemporaneous use of free motion and friction while in the water is of the greatest benefit. The advantage is no less evident in many cases of internal disease. We hold it therefore far from a matter of indifference in every case, which of the two forms of bath is used; and on this ground alone it will frequently be proper to give the preference to Bath as a place of resort for the invalid for whom warm bathing is recommended,—this being the only place in England where the warm bath, with the full benefit of locomotion, can be obtained.

7. *Influence of saline impregnations in modifying the effects of the warm bath.*—In the preceding observations, we have spoken of the water bath, without regard to its impregnation with saline or other extraneous substances. It is, however, necessary to notice these in this place. This subject is, perhaps, less regarded in this country than it ought to be. Many persons seem to consider only the temperature, deeming it a matter of indifference whether the water is that in common use for domestic purposes, or is that of the sea or of mineral springs. This is a very great mistake, and can only arise from inexperience or want of observation. Two or three trials on delicate and relaxed subjects will suffice to convince any one that the two kinds of baths are productive of very different effects. In general it may be stated that water containing mineral and saline substances in solution, is less relaxing and consequently more tonic than pure water. Such compound baths can be borne for a longer period, and are followed by less exhaustion than baths of pure water. Patients are also less liable to take cold after the former. When, therefore, the object is to produce great relaxation and exhaustion, as in certain cases of acute inflammation, pain, or spasm, the pure water bath is to be preferred; while, on the other hand, the saline or mineral water bath is to be administered if the object is not to exhaust but to refresh. In cutaneous diseases, sometimes one kind of bath will be preferable, sometimes another, according to the

nature of the case. The compound bath is certainly more stimulant to the skin, consequently more derivative from the internal parts; and this circumstance will, no doubt, account for much of the difference observed between the two kinds of bathing. It would, however, be both unphilosophical and unjust to consider the chemical composition of the water as a matter of indifference, provided the same degree of stimulus were communicated by it to the skin. Without pausing to examine the question as to the absorbing powers of the skin, and the actual transference of the materials of the bath into the blood through this medium, it is a matter of simple observation and fact, that the effects of bathing vary with the nature of the chemical composition of the fluid. The warm baths attached to the mineral springs of Bath, Buxton, Cheltenham or Leamington, Harrogate, Matlock, and Tunbridge-Wells, have each peculiar effects. The warm sea-water bath differs from all these; and, although the difference may not be often appreciable, there is no doubt a difference even in the action of river, rain, spring, and hard and soft pump-water respectively. In the cases in which the saline bath is considered preferable, an easy and in general an effectual substitute is afforded by the addition of common salt to plain water; and it will be found, in practice, that such addition is to be recommended in the majority of cases in which the warm bath is prescribed medicinally. When used as a measure of hygeiène, the saline bath is in almost all cases to be preferred.

§ 3. **Of the Tepid Bath,** (temperature of the water from 86° to 92°.)

The effects of the bath of a temperature considerably below that of the body, yet still communicating the sensation of warmth to the surface, are similar in kind to those of the warm bath, but inferior in degree. Generally speaking, the tepid bath is less pleasant, less animating, less soothing. It possesses neither the direct stimulus of the warm, nor the indirect stimulus of the cold bath. When prolonged, in place of the tranquillizing effects produced by the warm bath, it gives rise to a gradually increasing sense of chilliness and discomfort. Caloric is carried off from the body faster than it is produced, while the unstimulating and relaxing medium has no power, like the cold bath, to rouse the vital energies of the system to increased vascular action and augmentation of the processes that produce animal heat. In its medical effects, as well as in its thermometrical character, the tepid bath may be said to occupy a middle position between the temperate and warm baths. In all cases where we consider the warm bath indicated, but are apprehensive that from particular circumstances it may prove too exciting, we must of course reduce the temperature to the degree that can be borne. We formerly had occasion to observe that only the very lowest degrees of the warm bath are found tolerable by some persons; and we may add that, in some rare cases, even a still lower temperature is necessary. In such individuals the tepid takes the place of the warm bath as a matter of necessity. On the other hand, among the class of persons whose cases are commonly benefited by the temperate bath, some will be found whose peculiarity of habit will require the temperature to be raised within the limits of the tepid bath.

Besides these cases requiring the tepid bath from the idiosyncrasy of the patient, there are others which require it from the peculiar character of the affection. Of this kind are various mild febrile diseases connected with much irritability and a dry harsh skin; morbid states of the skin itself, in which there exist, at the same time, a very irritable and a dry and heated state of it. There are many other cases in which the tepid bath is beneficial, and which will readily suggest themselves to those who understand the principles on which the cold and warm baths are prescribed, and are practically conversant with their effects. Our limits oblige us to be contented with this general reference, and the very imperfect outline here given.

§ 4. **Of the Hot Bath,** (temperature 99° and upwards.)

This bath is a powerful but temporary stimulus to the skin and to the nervous and vascular system, and in a degree proportioned to its temperature. In the state of health, and in disease generally, it has no soothing effects; nor does it, like the warm bath, gently solicit and encourage the natural actions of the system, but impels them suddenly, forcibly, and irregularly. It tends more to disturb than to equalize action. The heart being powerfully excited, the blood is forced with rapidity through the whole vascular system, the pulse being raised ten, twenty, and even fifty pulsations in the minute, and increased proportionally in strength. This preternatural force of the circulation is felt in a particular manner in the head. The carotids are seen and felt to beat powerfully, and headach, giddiness, and other cerebral symptoms are of frequent occurrence. The combined effect of the increased action of the heart and the direct stimulation of the skin by the local heat, occasions a great afflux of blood to the surface, which becomes universally red and swollen. This determination of blood to the surface does not, however, like that produced by the warm bath, relieve the internal organs; on the contrary, it is very generally accompanied by great and irregular determination of blood to these parts. The great tension on the surface is, after a time, relieved by the breaking out of a general sweat on all parts not covered by the bath; and there is reason to believe that the same takes place on the parts that are immersed. The other secretions are, like the distribution of the blood, irregular and uncertain, some being increased and others diminished. If the bath is continued, although the pulse remains quick, the general excitement is speedily followed by universal languor, lassitude, and debility; and torpor and somnolency surpervene from exhaustion of the animal powers, as in the case of the warm bath they had been induced by the tranquillizing influence of the remedy on the sensations and the nervous system generally.

In their action, both the warm and hot bath are stimulant to the nervous and vascular systems, but in very different degrees and with very different results. The primary effect of the former may be compared to that of a moderate meal of plain and wholesome nutriment; that of the latter to the potent and sudden stimulation of vinous or other strong drinks; and their ultimate effects may also be said to be analogous. The gentle stimulus of the warm bath remains some time after its application, beneficially prompting and aiding the healthy actions of the system, and gradually vanishing in the habitual conditions of health; the hot bath, on the contrary, excites beyond the limits of safety, disturbs the normal actions of the system, and then suddenly disappears, leaving behind it exhaustion and debility, and frequently disease.

The warm bath is in common use as a measure of hygeiène and for luxury, as well as a curative agent. The hot bath is exclusively therapeutical, and its employment in this way is very circumscribed. We had occasion formerly to remark that there are certain peculiarities of constitution and states of disease where it is necessary to raise the temperature of the water above that of blood heat, before the ordinary effects of the warm bath are experienced. In ordinary cases, however, the bath at this high temperature produces the effects just described, and these are obviously of a kind which render it improper as a remedial measure in the great majority of instances in which the application of heat to the surface can be supposed to be indicated. The hot bath is, nevertheless, a valuable remedy in certain cases. Owing to its highly stimulating and exciting qualities, it is applicable to morbid states in which the warm bath, if not injurious, is at least of inadequate power; as, for instance, when we wish to produce a great and rapid excitement either of the general system, or only of the skin, or of both at the same time. It is therefore applicable in the following and other analogous cases: —

1. In extreme exhaustion, with a cold shrunk state of the skin and superficial parts of the body, and a concentration of the circulating fluids and the nervous energy in the internal organs. Examples of this morbid state are furnished by spasmodic cholera, certain forms of pernicious fever, ague, &c.

2. In sudden retrocessions of cutaneous diseases, both of an acute and chronic kind; scarlatina, measles, &c. &c. &c. In certain inflammatory affections of the internal organs, in which the circulation is equally concentrated in the interior of the system, and the pulse is too feeble and small to allow venesection to be performed: some forms of enteritis and gastritis, as from retrocedent gout, are of this kind; but the utmost caution is requisite in applying the remedy in all such cases.

3. In chronic diseases of the skin. In this case the bath is used chiefly as a topical remedy in some of the most obstinate and indolent forms, with the view of exciting the skin, and altering its physical and vital condition. Its application in cases of this kind requires great discrimination and caution; but with the proper care it is capable of being made a very powerful remedy.

4. In certain cases of paralysis of long standing, when there are no grounds for apprehending that the stimulating effects of the bath may induce fresh disease within the head. The very existence of the paralytic state frequently renders the system less susceptible of the stimulus of heat; and when this is the case, there is no doubt that an application so powerful and extensive as the hot bath must in many cases be productive of excellent effects. This remedy is in great use at Bath in such cases; the patients being accustomed to remain in water, of the temperature of 104°, upwards of an hour without suffering any inconvenience, and frequently with much advantage.

In most of the cases above mentioned, the object is to obtain the stimulating and not the debilitating effects of the bath; it ought, therefore, to be used at the highest temperature that is deemed proper, and continued only for a very short period.

All the cautions and contra-indications formerly delivered respecting the use of the warm bath, are still more necessary in the case of the hot bath.

§ 5. Of the Vapour Bath.

Forms of the vapour bath and modes of using it.—In treating of the warm bath it was almost unnecessary to notice the particular forms in which it is administered, as these differ very little from each other, either in their nature or effects on the system. The case is different with the vapour bath; there being several modes of applying this, which are productive of results respectively different.

There are two principal forms of this bath: —
1. The free or public vapour bath, steam chamber or humid stove, bagnio, Russian or Oriental bath.
2. The confined or solitary vapour bath, such as is commonly used in this country.

1. The free or Russian bath consists of a close room filled with vapour, in which the patient may move about at pleasure, and where many persons may bathe in concert. The chamber is commonly of considerable dimensions, and is arranged somewhat in the manner of a theatre, with benches rising one above another. In the Russian and German baths the vapour is produced within the apartment by throwing water from time to time upon red-hot stones, heated by a furnace underneath. By this process the whole room is soon filled with vapour, heated to a temperature varying from 112° to 160° or 180°, the heat, owing to the diminished gravity of the air, being progressively greater with the elevation of the benches. In the best arranged establishments there are various other apartments connected with the bathing-chamber. The bathers first enter an ante-room, not containing any vapour, but heated to the temperature of from 75° to 80°, where they take off their ordinary clothing, put on a proper dress, and then enter the bath. On first commencing the use of the bath, the patient commonly remains on the lower benches, where the temperature varies from 112° to 120°. At the successive visits he progressively ascends the benches until the temperature is 130° to 140°. During the bath it is customary to rub the body with soap-suds, wheaten-bran, &c., or to have it gently beaten with small leafy twigs. It is also common to apply a cloth, dipped in cold water, to the head or face, or to have cold water thrown on the head or some part of the body, from time to time, by means of a douche-tube, the water being applied either in an undivided stream, or in the form of a small partial shower bath. Having remained the requisite time, the bather descends from the upper benches, and after a short stay in this lower temperature he retires to another room

heated with warm air, where, after being dried, he puts on a flannel dress, and lies down on a couch for some time. Frequently, previously to lying down, the patient drinks some warm fluid, and takes other steps to encourage perspiration. He then returns to the ante-room, where it is customary to remain a short time after being dressed, in order that he may be somewhat cooled before going into the open air.*

2. The confined or solitary vapour bath is that in general use in this country. The distinctive character of this is that the patient is restrained from locomotion, being confined in a small close cell or tent of cloth, containing the vapour.

This form of bath admits of three modifications: *a.* the head of the patient being included in the apparatus, so that respiration is restricted to the air in which the vapour is suspended; *b.* the head, or at least the mouth, not being included in the apparatus, so that the patient breathes the common air of the apartment; *c.* the apparatus being so arranged as to admit of the patient breathing either the vapour of the bath or the external air at pleasure.

The vapour bath, as generally used in this country, scarcely requires description. It consists essentially of a small frame of wood surrounded by a woollen or other cloth impervious to vapour, enclosing a space little more than sufficient to contain the body of the patient seated on a stool in the centre of it. The vapour is admitted at the lower part of the apparatus by means of a tube connected with a vessel of boiling water. The more common modification of the bath used in this country is that which permits the patient to breathe the air or vapour at pleasure, by excluding or including the head through an opening in the side of the covering. Fixed baths of this kind are now common at all our watering-places, and in most of the large towns in the kingdom; and there are several varieties of the apparatus of a portable kind equally effective. The best of these are the modifications introduced by Captain Jekyll, Mr. Green, and Dr. Gibney of Brighton.†

General effects of the vapour bath. — As the principal effects produced by both the vapour and warm water bath depend, in a great measure, on the same cause, namely, the application of heat and moisture to the surface of the body, it is obviously unnecessary to enter on a detail of all the consequences resulting from the use of the vapour bath, as this would be to repeat, in a considerable degree, what has been already described. Our object will be sufficiently gained by stating, in this place, the chief *differences* which exist between the operation of the vapour bath and the warm water bath. These have chiefly reference to the bath as a medium of communicating heat, and as influencing the functions of the skin and lungs.

The difference in the heating power of different media was formerly referred to when treating of the water bath as a means of increasing the temperature of the body. It was there stated that the heating power was greatly influenced by the density of the medium, its capacity for caloric, its conducting powers, the relative fixedness of its particles, &c. *Cæteris paribus*, the more intense the degree in which these qualities exist in the medium, the greater is its heating power. The following are the highest temperatures at which the respective liquids could be borne by the hand of the same individual: spirits, 130°; oil, 129°; water, 123°; mercury, 117°. (Phil. Trans. vol. lxv. p. 111.) As a general bath, water can hardly be borne at the temperature of 120°; Rostan bore it with great inconvenience for half an hour, of the temperature of 115°. In the form of vapour, however, this fluid can be employed as a bath at much higher temperatures. The ordinary heat of the Russian or Oriental bagnio is from 120° to 140°; and it is occasionally raised as high as 180° or 190°. The same difference of results, as to the relative heating power of water and watery vapour, was observed by Dr. Edwards, in his experiments on animals. He could never get frogs to remain alive more than two minutes in water of the temperature of 104°, although the head was not immersed; while they survived the same degree of heat in vapour (and breathing it) upwards of five hours. (Loc. cit. p. 374.) When conveyed by the still rarer medium of air, it is well known that heat can be sustained, without inconvenience, at degrees greatly exceeding the highest now mentioned. In the experiments performed in heated rooms by Drs. Fordyce, Blagden, and Dobson, air of a temperature varying from 200° to 260° was borne for a considerable time with perfect impunity. A still higher temperature, viz. 270°, had been previously borne by some young women in France, as recorded by Tillet and Duhamel; and yet greater heat has been sustained by others since that time.

In respect of the heating power of watery vapour, an important difference results from the circumstance of its being breathed or not by the patient. The application of the vapour to the lungs tends to increase the animal temperature, not merely by reason of the additional surface thus exposed to the influence of the heating medium, but because such application puts a stop to the cooling process of evaporation constantly going on from the lungs in a dry air. It is extremely difficult to ascertain the exact ratio of the heating powers of water and of vapour in its two different forms of application. Judging, however, from the results of common practice in the different kinds of bathing, and from a pretty extensive examination of the observations and opinions of practical writers, we are disposed to place reliance on the following comparative view as containing as near an approximation to the truth as can be obtained on such a subject. For reasons of practical convenience we retain the ordinary divisions and titles of the warm-water bath.

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* *Osann*, in Encyclopädisches Wörterbuch der Med. Wissensch. Art. *Bad.* Band. iv. *Berlin*, 1830.

† Many substitutes for these more elaborate contrivances have been suggested, and may be extemporaneously employed with sufficient effect when such are not at hand. A thick blanket or two thrown round a drying-screen, or other frame of wood, and placed over a steam-tube connected with a common kettle, answers the purpose very well. The common slipper-bath may also be used for the same purpose, the patient being guarded from the sides of the bath by a covering of flannel, and the mouth of the bath being closed by a blanket placed round the patient's neck; the steam being admitted through an opening in the lower part of the apparatus. Perhaps one of the simplest, least expensive, and most convenient forms of the portable vapour bath, consists of a large open wicker basket, like that used by wool-staplers, reversed over the patient and covered with blankets, the patient being previously seated on a small stool or chair placed upon a piece of floor-cloth, near the chimney of the apartment The tube from a small portable steam-boiler, placed on the common fire, is introduced along the floor. The basket is so constructed, with a sort of open door at one side, as to admit of the exclusion of the patient's head at pleasure.

	WATER.	VAPOUR.	
		Not Breathed.	Breathed
Tepid Bath ..	85° — 92°	96° — 106°	90° — 100°
Warm Bath..	92° — 98°	106° — 120°	100° — 110°
Hot Bath.....	98° — 106°	120° — 160°	110° — 130°

Independently of its greater power of communicating heat to the body, when extended to the pulmonary surface, the vapour bath, when so applied, will necessarily exert a very different local influence than when its action is confined to the skin. This difference of effect must always be kept in view in prescribing the remedy in affections of the chest, or in persons predisposed to these.

There is little doubt that at the corresponding degrees of temperature, the vapour bath occasions a greater degree of cutaneous transudation than the water bath, a circumstance easily explained by the difference of the two media as physiological agents. We would, however, make one remark here in reference to this point, as it is of practical importance, and this is, that a part of the additional perspiration experienced in the vapour bath often arises from the disproportionate degree of temperature employed. Much greater latitude is commonly permitted in regulating the heat of the vapour bath than of the water bath: and we know that the former is often used at temperatures corresponding with those of the *hot bath*, when it is intended to be used—as a *warm bath*. One of the causes of increased transudation in the vapour bath arises from the greater accumulation of fluids in the cutaneous and superficial tissues, a necessary physical result of the greater rarity of the medium; and this circumstance, moreover, constitutes the vapour bath a more powerful derivative, *cæteris paribus*, than the water bath.*

It is particularly necessary in using the vapour bath to attend to the actual temperature as indicated by the thermometer; even more so than in the case of the water-bath; the gradual increase being less felt owing to the greater rarity of the medium. And the caution is still more requisite because, in using the vapour bath, the temperature is gradually raised to the proper degree, after the patient is in the bath.

Medical uses of the vapour bath.—Generally speaking, the solitary vapour bath in which the head is not included may be said to be applicable in the same cases as the warm water bath, and to be productive of similar results. An attentive consideration of the peculiarities of action of the two kinds above noticed will point out the particular cases in which the one is to be preferred to the other. The vapour bath at the *corresponding* (*not the same*) degree of temperature must be considered as upon the whole more derivative to the surface, more diaphoretic, and probably less stimulating generally. It seems, however, to have a less soothing effect on the nervous system. This result, in some cases at least, is partly owing to the more constrained and to the upright position in which it is usually taken. The reclining posture used in the solitary water bath, where no muscular effort is required to keep the body in its position, gives it a decided superiority over the common vapour bath or large water-baths, in cases of great debility or severe disease. In such cases, however, by a particular contrivance, the vapour may be applied to the patient in bed.

Most of the cases formerly noticed under the head of the warm bath are equally benefited by the vapour bath, and some seem more benefited by the latter. We shall only here refer to one of these, namely, the well known condition of the system which precedes many acute diseases, and which is familiarly known by the name of *a chill*, because it is usually produced by the application of cold. This state often exists for several days before the re-action of disease and fever supervene. It is the usual precursor of acute catarrh or bronchitis, asthma, pneumonia, rheumatism, diarrhœa, or dysentery, &c.; in a word, of the numerous class of inflammatory diseases which derive their origin from cold. In most of these cases the vapour bath is a very effective remedy if administered at the proper time and in the proper manner. The most proper time is the earliest possible after the application of the morbific cause; but the remedy may still be applied with benefit, although with much less effect, at any time previously to the actual establishment of the local inflammation. After this has taken place, or is about to take place, the application of the bath will, in most cases, be more injurious than beneficial. In cases of the kind now under consideration, the vapour bath, particularly if the vapour is breathed, appears to possess decided advantages over the common warm water bath. But although fully convinced of the admirable effects likely to result from this mode of treatment, we cannot consider it as a practice to be had recourse to at the discretion of patients, without medical sanction, as, like all powerful remedies, it is capable of doing harm as well as good. Under proper regulation, we have little doubt that it will in many cases effectually check the morbid process, which, if left to nature, must end in formal disease. The temperature in cases of this kind should not be high. The object being to derive to the surface without exciting the circulation, the application of the vapour should be commenced at the lowest degree which is felt to be agreeable, as about 95°, and the temperature should be gradually and slowly raised, and should rarely exceed 106°. The more copious the perspiration that can be excited at a moderate degree of heat, the more likely is the result to prove beneficial.

§ 6. Of the Warm Air Bath.

The temporary exposure of the naked body to the air of a common chamber has been termed the *air-bath*; and although it has not often been formally prescribed in disease, it has frequently been had recourse to as a means of relieving slight degrees of feverish restlessness. It was practised and recommended for this purpose by Franklin. The immersion of the body in air of which the temperature has been artificially raised, is a therapeutical mean of much greater power, and has been extensively used as such. This is what is termed the *warm air bath*. Like the vapour bath, it is of two kinds, according as the air is breathed or not breathed. Warm air chambers have been employed on a great scale, as luxuries, by persons in health, and especially by the ancient Romans. They are still occasionally used for medical purposes, but more frequently as appendages to vapour baths than as distinct baths. The heated air chamber has, however, formed a frequent medium for experimenters to ascertain the effects of high degrees of heat on the animal body. The experiments of Drs. Fordyce, Blagden, and Dobson, in England, of Delaroche and Berger, in France, and of many others, undertaken with this view, were formerly noticed and are well known. We allude to them here, only for the purpose of again remarking, that owing to the great rarity of the medium and to the cooling effects of the evaporation produced by the dry air, a very high degree of temperature can be sustained in air with little inconvenience. Much lower temperatures, however, than were borne in these experiments, suffice to produce all the stimulating effects of the ordinary hot bath, whether of vapour or water. In the experiments of M. Berger and Delaroche in air of a temperature varying from 150° to 190°, the following effects are noticed: — A considerable degree of smarting was perceived in different parts of the surface, particularly in the eyes, nose, and nipples; the superficial veins became universally dilated; the surface, at first burning hot, was soon covered with general and very copious perspiration. The temperature of the body was raised several degrees; the pulse rose to 160; the respiration became anxious; and headach, vertigo, and other symptoms of cerebral disorder took place. The above temperatures represent those which correspond with the higher degrees of the hot water bath. Much lower, therefore, are employed when we wish to produce effects corresponding to those of the warm water bath.

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* It is, probably, in this circumstance of the relative amount of superficial compression in the two cases, that we are to find an explanation of a phenomenon frequently experienced in the water bath, and very rarely in the vapour bath. We allude to that feeling of præcordial oppression on first entering the bath, which is so distressing to many persons, and which, indeed, occasionally renders this form of bathing impracticable; the sudden retropulsion of the blood from the whole surface of the body upon the heart and lungs giving rise to the feelings of distress alluded to.

The warm air bath is now most commonly used as a solitary bath, the patient not breathing the heated air. By much the most convenient form of the apparatus is that introduced a good many years since by Dr. Gower, under the name of the *sudatorium*.* This consists merely of a semi-cylindrical frame-work of wicker, laid over the patient in bed, and covered with blankets. By means of a metallic tube communicating with the end of the frame, a stream of air, heated by a lamp placed at the extremity of the tube, is directed into the hollow space formed round the patient. The speedy and almost certain effect of this bath is to produce copious general perspiration. It may be used at different temperatures, and be so regulated as to correspond with the divisions adopted in the case of the water and vapour baths. Although, as we have stated, a much greater degree of heat is required in air than in vapour to produce either the elevation of the animal temperature, or the stimulating effects on the system, still it is found, by experience, that a moderate degree of heat is alone necessary to excite copious perspiration. No doubt the sudatory effect is greatly promoted by the rarity of the medium applied to the surface. Dr. Gower informs us that he found the most profuse sweating take place when the air was only of the temperature of 85°, and he adds that he "had reason to believe that at a much higher degree the effect would be rather frustrated than increased, owing to the ardent heat which the patient feels and complains of, without obtaining the relief which sweating invariably produces." Our own experience with this apparatus does not quite correspond with this statement of Dr. Gower. We have, however, found that very copious perspiration may be excited by a temperature not greatly above this, viz., from 90° to 100°; and we are of opinion that even when we use this bath more with the view to stimulate the surface than to excite perspiration, it will seldom be requisite to elevate the temperature beyond 120°, or at most 130°.†

The warm air bath is most analogous in its operation to the vapour bath; yet it is considerably different from it. It seems to possess all its stimulating qualities without its relaxing and soothing effects. It is, therefore, a much more exciting application at the corresponding temperatures. It appears to be more powerfully derivative to the skin than any other bath, and more certainly productive of perspiration within a short period.

There are three classes of cases in which the warm air bath seems to be particularly indicated: —1. in chronic rheumatism and other pains and stiffness, as of the joints; 2. in morbid states of the skin, more particularly in dry scaly eruptions; 3. in acute diseases marked by great exhaustion and retrocession of blood from the superficial parts of the body, as in certain forms of fever, and in the malignant or spasmodic cholera. In the last-mentioned diseases, (which alone we shall notice in this place,) and in others of the same class, the warm air bath, employed on Dr. Gower's plan, has great advantages over all other kinds of baths, inasmuch as its effects on the system are as powerful, while its application can be made without trouble or inconvenience, and without any risk of yet farther exhausting the patient.

This bath was occasionally used by the late Dr. Armstrong in that form of fever which he termed *congestive*. The following brief extract from his lectures will point out the cases in which he recommended it, and the fortunate results which he obtained from its employment. "The whole surface is chilly; the blood has retreated from the surface, and has been accumulated in some internal organ, where it undergoes almost a complete stagnation, or at least produces a complete interruption of the venous circulation. A derangement of the functions of that part is the result, and, if that part be important, of the functions of the whole body. The use of the hot air bath is to rouse the energies of the system; and in some of these cases the patient is raised, as by the touch of a magic wand, from weakness to strength by its application." (Dr. Armstrong's Lectures. Lancet, vol. v. p. 74.)

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* See his little work entitled "Auxiliaries to Medicine." London, 1819.

† The warm air bath, and its great power in inducing perspiration, were well known to the older practitioners. "Aliud genus balneorum est (says Hoffmann) quæ audiunt vaporosa sive Laconica. In his vapores, sive *sicci calidi ex accenso vini spiritu halantes*, sive calidi humidi ex decoctis herbarum cum vino vel aqua surgentes, immediate ad universum corpus vel ad certas duntaxat ipsius partes, admittuntur. Est autem calidorum ejusmodi halituum maxima vis ad eliciendum sudorem, tubulos subcutaneos aperiendos," &c.—*F. Hoffmann*, Op. Om. tom. i. p. 465.

We have much pleasure in laying before our readers the following notice on the same subject, with which we have been favoured by Dr. Tweedie:—

"It sometimes happens that the febrile poison is so intense, and the living power so depressed by it, that, the subsequent efforts of the system to bring on re-action being ineffectual, the patient is suddenly placed in great danger, and often dies in a few hours after the first appearance of the symptoms. Under these circumstances the surface feels cold and damp, more especially on those parts which are at a distance from the centre of the circulation; the pulse is feeble and compressible; the functions of the brain are disturbed; the breathing is anxious and hurried, and the lips are livid. All these symptoms depend on the peculiar operation of the febrile poison on the nervous system, and on the irregular distribution of blood consequent to this. This fluid, probably changed also in its properties, recedes from the surface, and accumulates in the internal organs. In other instances, sudden collapse supervenes in the more advanced stages of fever, and similar symptoms make their appearance. In such embarrassing circumstances, much judgment is requisite to rescue the individual from the danger in which he is plunged. Some writers have recommended blood-letting with the view of relieving the congestion which is supposed to have taken place in the internal organs. This treatment may, in some instances, have been beneficial, though it appears to me that it can only be adopted when the circulation, though oppressed, is still carried on with some degree of vigour; because, should blood be abstracted when the heart's action is weak, fatal syncope may be induced. It should be remembered that, though the heart's action is, in such cases, oppressed by the accumulation of blood which it is unable to propel, this want of power in the heart is primarily induced by the peculiar action of the febrile poison on the whole nervous system. In this debility the heart, of course, participates. In this state of things, more benefit certainly results from the exhibition of diffusible stimulants, while at the same time efforts are made to determine the blood to the surface by the application of the warm air bath. In cases of collapse coming on in the later stages of fever, bleeding is out of the question: the patient, already exhausted, is thrown into a species of continued syncope; and from this he is to be roused by the cautious administration of stimulants, and the application of the hot air bath. The exhibition of stimulants is only to be continued while the pulse continues feeble and soft; they are to be immediately withdrawn, or given at more distant intervals, when re-action has taken place."

The pathological state in the early stage of malignant or Indian cholera is very analogous to that in congestive fever; and the indications of treatment seem precisely similar. In such cases the warm air bath, speedily raised to a high temperature, offers one of the best means of fulfilling these indications; and we are happy to observe that very general preparations are making to give it a trial in the disease that has just (Oct. 1831) broken out at Sunderland.

[This remedy was extensively used in the cholera hospitals in different countries, and was as serviceable, perhaps, as any other external agent.]

This would be the proper place to notice the other forms of baths in which the heated air is combined with sulphureous and other dry vapours; but the consideration of these, as also of the medicated humid vapour baths, particularly the chlorine bath, must be postponed to another occasion. At present we must content ourselves with referring to the works of MM. Gales and Rapou, and to the publications of Dr. Wallace, of Dublin.

JOHN FORBES.

BERIBERI. The disease usually denominated beriberi was, we believe, first scientifically described by Dr. Rogers, who published a thesis on the subject in 1808, at Edinburgh. He denominates it *hydrops asthmaticus*, a term which conveys an imperfect notion of the pathology of the disease, a paralytic affection of the lower extremities being, perhaps, a more constant symptom of beriberi than dyspnœa and dropsical effusion. Dr. Mason Good calls it *synclonus beriberia*, and gives the following definition:—"Spasmodic rigidity of the lower limbs, impeding locomotion; often shooting to the chest, and obstructing the perspiration and the voice: trembling and painful stupors of the extremities; general œdematous intumescence." This definition is tolerably accurate; but in his description he confounds a chronic paralytic affection (*barbiers*) with the acute disease now under consideration.

The word *beri* is stated by Staff-Surgeon Marshall, in his Notes on Ceylon, to imply, in the Singhalese language, *weakness* or *inability*; in fact, we may consider it as a generic name, agreeing with our word *disease*. The repetition of the term *beri* conveys an idea of the greater intensity or degree of debility. Beriberi is characterized by oppressed breathing, general œdema, paralytic weakness, and numbness of the lower extremities. The attack is sometimes very sudden, but more commonly the patient complains for some days previously of languor, weakness and inability, or unwillingness for motion. The first appearances are numbness and stiffness of the extremities, with œdematous swelling of the feet and legs. These symptoms often show themselves simultaneously. The patient experiences great weakness and breathlessness, especially on motion; the anasarca extends upwards over the body, accompanied with a peculiar feeling of numbness, with fulness, and a sense of weight and oppression in the scrobiculus cordis; the face becomes swollen and bloated, and the lips are pale; in the advanced stage they are blue and livid: dyspnœa is always present in a greater or less degree, and is much increased by exertion; the pulse is usually quick, small, and hard, sometimes little affected, but as the disease advances, becoming irregular and intermittent; the stomach is often very irritable, especially in the advanced stages of the disease; the bowels are constipated, the urine is high-coloured and scanty, and sometimes suppressed. As the disease advances, the dyspnœa and anxiety become most distressing; the sleep is unsound and interrupted; the patient complains of violent palpitation, and experiences great uneasiness, especially in a recumbent position; the feeling of weight at the præcordia increases, and spasms of the muscles of the chest and abdomen take place: vomiting becomes incessant, the pulse sinks, the lips and countenance assume a livid hue, and the patient is carried off in a state of suffocation. In cases where debility, oppression, anxiety, and dyspnœa are extremely severe from the beginning, the patient sometimes dies in a space of time varying from six to thirty hours. When the symptoms are less violent, the disease may continue for three weeks or a month, or, as frequently happens, the patient experiences a number of relapses, and is at last carried off suddenly, sometimes after the dropsical symptoms have subsided, and he seems to be convalescent. Mr. Holloway had two patients, who died without appearing to awaken from a state of sleep. In general, however, death is immediately preceded by great agony.

The writer of this article had an opportunity of witnessing the phenomena attending this disease at Trincomalee, in the Island of Ceylon, where it prevailed in 1815. In some of the cases that came under his notice, the external or anasarcous symptoms were apparently unimportant, although death was the result. Some of the patients expired who appeared to be recovering, and who stated, shortly before death, that they were better than they had been for several days. The dropsical effusion did not by any means appear to be the immediate cause of death, and Dr. Christie states that some of his patients died who had no decided anasarcous symptoms; the face was, however, bloated and leucophlegmatic.

Beriberi was very prevalent in various parts of Ceylon from 1795 to 1803. In the former year two hundred Europeans died in Trincomalee, chiefly from this disease. (*Rogers* de Hydrope Asthmatico.) It also prevailed at Colombo, both among European and native troops. During the Kandyan war in 1808, its ravages were severely felt. Among Europeans, those engaged in certain occupations, such as tailors, smiths, &c., were especially liable to beriberi; while commissioned officers, women, and children, were generally exempted from it.

This disease appeared in a comparatively mild form in Kandy, in 1820–1, and ever since it has been little known in Ceylon. Beriberi prevailed among the troops in the Carnatic in 1782–3.* Mr. Hamilton says, "it is principally, if not entirely confined to Ceylon, to the Malabar Coast, and to that tract of country reaching from Madras as far north as Ganjam, in no part extending inland more than 40 miles. It is most prevalent during the decline of one monsoon and setting-in of another, when the atmosphere is loaded with damp, raw, cold vapours, and the vicissitudes of temperature are greater than at any other season of the year; and the instances are comparatively rare where it has been found to occur at a distance from the sea exceeding sixty or seventy miles." It may be remarked, however, that Kandy, where the disease was particularly severe, is at a much greater distance from the sea. At Trincomalee it was observed that the most severe cases occurred during the change from wet to dry weather, where a strong and hot land-wind prevailed; whereas at Palitoopane it appeared in 1814, while the weather was remarkably dry.†

Dr. Christie has remarked, that a residence of some months at a station where the disease prevails seem essential to its production. Dr. Rogers never saw it attack an individual who had been less than six months in Ceylon. Beriberi occasionally occurs at sea, especially among Lascars (Indian seamen) on the outward-bound voyage. Dr. Hunter has given a particular account of the probable causes, and of the treatment employed in several of the East-India Company's stations where it prevailed.

The remote as well as the proximate causes of this disease are extremely obscure. Drs. Christie and Rogers, and several other medical gentlemen who observed it in Ceylon, considered it a disease of debility, arising from a want of stimulating and nourishing diet, impure air, and exposure to a moist and marshy atmosphere while the frame is debilitated by residence in an unhealthy station. How far these circumstances contributed to predispose the system to beriberi, it is difficult to say.

Mr. Marshall (Notes on the Med. Topography of the Interior of Ceylon) remarks that "during the insurrection in Kandy (1815), the troops and public followers were greatly exposed to variable weather, privation in regard to food, and other causes of physical and mental exhaustion. Fortunately, however, beriberi did not supervene."

Mr. Colquhoun and others who adopted every available precaution with respect to food and clothing, were mortified to find that the disease did not seem to be materially checked by their prophylactic measures. No particular cause could be assigned for its appearance in the 19th regiment, at Trincomalee, in 1815.

There is extremely little accurate information before the public in regard to the organic changes which occur in this disease. The skin is usually pale and colourless; and Dr. Christie observes that a remarkable degree of obesity exists, even after a long continuance of the disease. The cellular membrane in general is found infiltrated with serum; and Dr. Rogers states that he discovered a small quantity of fluid effused between the brain and its membranes, as also in the cerebral cavities. Mr. Hamilton says that he observed general vascularity in the brain, effusion of fluid into the ventricles, with appearances of congestion in the medulla spinalis.

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* Med. Commentaries, vol. x. and Trans. of the Medico-Chirurgical Society of Edinburgh, vol. ii. 1826.

† *Ridley*, Account of an Endemic Disease of Ceylon. Dublin Hos. Reports, vol. ii. p. 227, and Essay on the Diseases incident to Indian Seamen on long Voyages, by *W. Hunter*, Calcutta, 1804.

A greater or less quantity of serous fluid is usually found in the cavities of the pleura and pericardium. Dr. Rogers states that it varied from a few ounces to two pounds in the former, and in the latter from two to twelve ounces.

In a case related by Mr. Marshall, the fluid in the pericardium amounted to four ounces. Mr. Hamilton describes a case where "a large quantity of fluid was effused into the cavities of the pleura, but none into the pericardium, though on this membrane, both externally and internally, there existed evident marks of inflammation." The lungs are gorged with blood and watery fluid.

In the abdomen a quantity of fluid, varying from two to three pounds, is commonly found. The liver is invariably described as being unusually large and very dark-coloured. Mr. Marshall states that in his case, on removing it from the body, a great quantity of dark-coloured blood flowed from the large vessels, and that it then became reduced in size and natural in colour. The whole substance of this viscus is commonly gorged with blood.

Several other traces of disease, such as inflammation of the diaphragm, intestines, &c., are mentioned by authors, but so loosely, that little reliance can be placed on their description.

Diagnosis.—It is scarcely necessary to enter much into the diagnosis of this disease. The paralytic symptoms, together with the dyspnœa and dropsical effusion, would appear sufficient to distinguish it from other diseases. The *mal d'estomac* and *cachexia Africana*, which have often been confounded with beriberi, are totally different diseases.

The real nature or pathology of this disease is as obscure as its origin. We know nothing satisfactory respecting the origin of the paralytic symptoms, nor regarding the immediate cause of death, where there is little or no dropsical effusion. Accurate observation and more extensive experience are wanting, to enable us to arrive at any thing like a satisfactory conclusion on the subject. From what we have seen of beriberi, and from our subsequent experience in other diseases, we are strongly inclined to consider the dropsical affection as the result of inflammation. In fact, it seems to be one of the numerous modifications of acute dropsy that affect the cellular membrane generally, but more particularly the cellular texture of the lungs, whereby a condition similar to that described by Laennec, under the name of œdema of the lungs, is produced. We have often been struck with the resemblance in the countenance and general appearance in patients affected with beriberi, and in the suffocative disease, with œdematous effusion, which attacks children after measles or hooping-cough.

In no disease with which we are acquainted, is internal congestion so strongly marked as in beriberi. How far this congestion may be the origin of the paralytic symptoms is a difficult question. Mr. Hamilton attributes them to congestion of blood in the brain and spinal marrow.

Treatment.—The method of treatment pursued by Dr. Christie, and recommended by him to the medical officers in Ceylon during the prevalence of beriberi in that island was in correspondence with the views then entertained of the nature of the disease. The patients were at once put on a course of calomel and squills; saline and antimonial medicines were also given, and the strength supported by cordial liquors, generally gin-punch: the sheet-anchor, however, as Dr. C. forcibly expresses it, was mercury, given so as to induce ptyalism. He adds that, "by these medicines the symptoms in the milder cases are very often removed in the course of a few days, except the numbness of the extremities, which generally remains longer than the rest." The pediluvium and stimulant liniments to the extremities were then ordered, and the patients were put upon a tonic plan of bark and wine, or porter, which was continued for some time after all the symptoms had disappeared. In the more severe cases, where the dyspnœa, vomiting, spasms, or other symptoms were violent, it was necessary to apply blisters to the breast, to make use of fomentations and the hot bath, and to exhibit the strongest cordials and anti-spasmodics, such as brandy, and particularly laudanum and vitriolic ether. "By these means I have," says Dr. Christie, "in most instances been enabled to relieve the dyspnœa and other urgent symptoms, and procure time for the exhibition of the medicines mentioned above, which it is sometimes necessary to use for several weeks." Digitalis was tried, but without any decided effect.

Mr. Colquhoun also trusted to mercury in this disease; but he remarks that salivation did not avert the fatal termination, for the patients who died in hospital were frequently in a state of ptyalism.

During the period in which the writer of this article had an opportunity of witnessing beriberi at Trincomalee, the method of treatment laid down by Dr. Christie was strictly pursued, but with little cause of congratulation as to its success. The patients frequently sank while under the influence of mercury; and he has often regretted that the dyspnœa, discoloration of the countenance, &c., did not lead to a different mode of treatment.

Mr. Hamilton treated the first two cases which came under his charge according to Dr. Christie's plan, and both proved fatal. Dr. Hunter says that in one of the outward-bound ships venesection was had recourse to, but without any effect, either of accelerating or retarding the disease. Dr. Rogers, in his Dissertation already referred to, has the following words: "Quin et ad phlebotomiam tandem cursum ejus funestum celerius absolvit." Increased experience appears to have induced Dr. R. to alter his plan of treatment, for we find from Mr. Hamilton's statement, that in 1822 he approved of bloodletting, and successfully employed it in two cases.

Mr. Marshall remarks that in 1820 many cases of anasarca occurred among the European troops in Kandy: the first cases were comparatively mild, and a considerable period elapsed before the well-marked and pathognomonic symptoms of beriberi appeared. Brisk cathartics and confinement to bed generally reduced the swellings and relieved the numbness in a few days. In a case where the chest was severely affected, great and speedy relief was obtained by copious and repeated bleeding. The depleting method of treatment was followed by Dr. Paterson, in the hospital of the 45th regiment, then under the superintendence of Mr. Marshall, with decided advantage. Mr. Hamilton, as has been already stated, having treated two cases unsuccessfully, was led, from the morbid appearances, to adopt other remedial means. In the next patient who came under his care, thirty ounces of blood were drawn, pleno rivo, from the arm. The blood was buffed, and the operation was attended with great relief; but as the symptoms returned, venesection was repeated to the amount of thirty-five ounces, with good effect. Mercury was then had recourse to, with laudanum, the vapour-bath, inunctions of mercurial ointment, with purgative doses of calomel and gamboge till the cure was completed. A similar mode of treatment was pursued in two other cases, in one of which blood was drawn, to the extent of sixty-five ounces, at three different times in the course of thirty hours.

According to the views supported in the former part of this paper, it will be seen that our mode of treatment would be in accordance with that pursued by Mr. Marshall and Mr. Hamilton. The quantity of blood to be drawn must of course depend on the state of the disease, and the constitution of the patient; but we should scarcely feel inclined to recommend the large and successive bleedings employed by Mr. Hamilton. If the patient be placed in an upright position, and the blood be drawn in a full stream, a smaller quantity will produce a more decided effect on the system, with less risk of producing subsequent debility. Free purging by calomel and gamboge, while the secretions of the mucous membrane and kidneys are stimulated by cream-of-tartar, squills, &c., with the use of the vapour or warm bath, and stimulating liniments to the limbs and spine, and blisters to the chest when the symptoms require it, will prove useful assistants in the treatment of beriberi. We may conclude with Mr. Marshall's remark, that a more extended clinical experience is still necessary, before a due estimate can be made of the true efficacy of the depletory means of cure.

J. Scott.

BLISTERING. (See Counter-irritation and Derivation.)

BLOOD, (DETERMINATION OF.)—This term is used to denote an afflux of blood to a particular part, impelled by increased arterial action. When such afflux exists without any obvious increase of impelling power, it is denominated congestion. Both may co-exist; that is, congestion may first take place, and, on vascular action becoming excited, determination may ensue, increasing still further the congestion, and superadding those lesions which determination more especially occasions; or congestion may be produced by determination, and may continue after this has subsided.

Congestion is more or less a passive condition; determination is always active. On determination subsiding, congestion may yield to the sanative powers of the constitution, unaided by medicine; or it may continue, and require special means to be resorted to for its removal.

When congestion takes place in any part, its origin must be ascribed to some weakness of the vessels of the part, causing them to yield to the ordinary force of circulation; in determination, vessels which would resist the ordinary force of vascular impulse may become over-distended by increase of momentum; yet here there must be some relative weakness to cause them to give way. The relative facility of yielding to distension, thence arising, whether natural or acquired, may influence the locality of the determination; or this may be directed by various sympathies and nervous connexions, and also by some peculiar property of the stimulus which produces the vascular excitement. Some determinations are solely attributable to nervous sympathy, as those which occur in health under mental emotion. In blushing, for instance, there is obvious determination of blood to the cheeks; nay, when intense, to the whole neck and breast. Similar instances might be adduced, but it is needless to advert to them, morbid determination being the condition under consideration. It is, perhaps, from the influence of nerves in giving direction to local determination, that certain stimulants determine blood more particularly to certain organs, some causing blood to flow more particularly to the brain, while others tend to induce vascular fulness in the liver or in other parts.

Determination admits of being inferred from the symptoms which denote it, these varying according to its seat, and to the functions of the part affected; the fact of its occurrence is amply verified by necroscopic examination when opportunity for this is afforded.

As determination may ensue upon congestions, so may it be followed by, or pass into, inflammation, of which indeed it seems to be an essential constituent. But as congestion does not necessarily produce determination, neither does determination pass necessarily into inflammation. Such determination, though an advance towards inflammation, and prone to pass into it, may yet exist so as to constitute formidable disease, and thus continue for an indefinite time without inflammation ensuing. Congestion of blood, kept up by determination, may take place in the brain, lungs, liver, or any other organ, without evincing the peculiar phenomena of inflammation, and may, in each, cause appropriate disturbance of function to a formidable extent. When such cases are treated as subordinate degrees of inflammation they yield readily, and to practice less active than inflammation would require; but when from the absence of purely inflammatory symptoms, they are referred to debility or some unexplained nervous derangement, and are in consequence treated with stimulants, they rather become aroused into inflammatory action, which perhaps is in such cases the happier result, as they are then treated aright; or they lead insidiously to disorganisation of structure, thus laying the foundation of some of the most irremediable of human diseases; for though medicine can do much to correct functional disturbance, and can to a certain extent promote even restoration of structure where the organic change has been slight, it cannot supply new organs, nor give to a scirrhous and disorganised mass the efficient energies of a healthy viscus. On which account the study of determinations, and of the causes both local and constitutional from which they arise, is of the highest importance, as a just conception of their nature and tendencies may enable the practitioner to avert, by very gentle means, lesions of the frame which, if suffered to advance to a certain extent, the utmost efforts of his art may be unable to remedy. In this instance the maxim, "principiis obsta" cannot be too forcibly inculcated. The special determinations, however, belong not to this place; they either constitute, or are connected with, special diseases; under each of which they will of course be found respectively noticed.

EDWARD BARLOW.

BLOOD, (MORBID STATES OF.)—The term *blood* needs no definition. Every one knows that the blood is that fluid which is circulated chiefly by the powers of the heart and arteries, over the whole animal frame, of every part of which it constitutes an essential ingredient. The blood must be first viewed as arterial and venous. The former, of a florid red hue, flows from the extreme parts of the lungs to the extreme parts of the system; the latter returns from the system to the lungs. The blood itself is only one degree more essential to life than its arterial character. In all the high orders of animals of adult age, life ceases in a few minutes after the blood is prevented from assuming the arterial character in the lungs, by cutting off the contact of the atmospheric air. In proportion as the individual is younger, however, it bears the exclusion of the atmospheric air better, and the detraction of blood worse. The blood, as it flows along or from the large vessels, has the appearance of a homogeneous fluid, of a red colour, of a rather viscid consistency, having a peculiar flesh-like odour, and an unctuous feel. Seen flowing along the capillary vessels, or placed upon a portion of glass, by the aid of the microscope, the blood presents the appearance of globules floating in a serous fluid. Stagnant, or removed from its vessels, the blood soon loses its homogeneous character, and divides into two portions, of which one is more solid, and termed the *cruor* or crassamentum, the other more fluid, yellowish, and transparent, and denominated the *serum*.

We purpose dividing the subsequent remarks, to which we shall endeavour to give a practical character, into two sections: the first will treat of the natural, the second of the morbid state of the blood.

There are several modes of analysis of the blood: the first is chemical, and consists in determining the secondary and ultimate elements into which the blood may be divided; the second may be designated the physiological, and would consist in determining the elements of the blood as it exists in the different parts of the arterial and venous systems, under various circumstances; the last, which will alone occupy us in this place, may be viewed as the *clinical*, and consists of observations on the blood and its several parts, as it undergoes its spontaneous changes on being drawn from an artery or vein. We have designated this kind of analysis clinical, because it is principally this which daily becomes an object of greater interest and importance. We, however, by no means wish to exclude the other modes of analysis from clinical inquiry.

The first part of this clinical analysis of the blood is, as we have stated, into cruor and serum. On a minuter examination, it is found that the cruor consists of two different matters, very easily separable from each other, by immersion or washing in water. The more solid part of the cruor is, by this simple process, deprived of its colouring principle, becomes whitish, and appears fibrous: it is designated *fibrine*. The colouring matter is more or less dissolved in the water: it has been denominated *hæmatosine*, (from αἷμα, αἵματος, blood,) to denote its constituting a peculiar and essential part of the circulating fluid. Hæmatosine is not a simple substance. It is composed, according to Berzelius, of .500 of oxide of iron, .750 of subsulphate of iron, .200 of magnesia, .200 of chalk, and .165 of carbonic acid. The serum is, in its turn, susceptible of a simple analysis. Heat, or alcohol, induces the coagulation and deposit of one of its principal constituent parts; this is termed *albumen*.

One of the first occupations of the medical student should be, to become familiar by actual experiment with these different substances. The experiment itself is one of the simplest and most instructive. We learn by it at once the partial solubility of hæmatosine, the insolubility of fibrine, the solubility of albumen in cold water, and its insolubility in hot.

The texture of the cruor, the quantity, apparent and real, of the serum, vary; the serum is sometimes slightly opaque; the hæmatosine is occasionally partly precipitated to the bottom of the vessel in which the blood is received. But these are probably morbid conditions, and will be considered in the ensuing section.

Besides the albumen, the serum contains various substances, of which the following are the enumeration and proportions according to Berzelius: water .905, albumen .080, chloruret of potassium and sodium .006, lactate of soda united to an animal matter .004, carbonate of soda, phosphate of soda, with animal matter .004. Doubtless each of these substances has an important influence in the animal economy. The little we know of their influence should only excite us to further inquiry in regard to these substances.

Besides these matters, according to the analysis of Berzelius, other substances have been discovered in the blood: as carbonic acid, substances severally resembling mucus, oil, brain, the colouring matter of bile, and of the urine and urea.

For more minute details we must refer to the various systems of chemistry. The clinical analysis of the blood must almost inevitably be confined to the more obvious results of observation, although we dare not exclude experiment altogether.

Arterial blood is less abundant than venous. It separates more promptly into cruor and serum. It contains less albumen, and is at once less viscous and less serous. Dr. J. Davy found that it possesses less specific gravity. It is said to have less capacity for heat. It has more of the peculiar odour of blood.

One of the most interesting questions in this inquiry is that which relates to the differences in the blood in the first and later periods of life. It is a singular fact that the globules of the blood in the fœtus are larger than those of its mother. According to Prevost and Dumas, they are of double the magnitude of those of a man of adult age. According to Fourcroy and Dr. Davy, the albumen is more abundant, and the fibrine less firm in infants than in adult age.

It is said that differences are perceptible in the blood of youth and old age, and of the two sexes. M. Barruel has recently occupied himself with the latter subject.

§ 1. It may be safely alleged that there is no external agent which may not, under extraordinary circumstances, become the cause of disease: it may also be alleged that there is no internal part, whether it be solid or fluid, in which the seeds of disease may not be sown.

The blood, of all the fluid parts of the animal economy, seems, from its complicated formation (may we not say structure?) to be most liable to morbid changes. The older physicians observed the dissolved state of the blood, as it was termed, in some cases of fever and scorbutus, and the singular appearance called buff upon the crassamentum in certain cases of inflammation. Had they not unfortunately deviated from the course of pure observation, we should now have possessed a series of facts of extreme value. But from the moment that certain unfounded chemical and humoral notions began to prevail, and physicians to speak of the acidity, the alkalinity, the acrid, the putrescent state of the blood, and of chyle, of milk, of pus, of bile in the blood, from mere hypothesis, observation was at an end. The error being detected, the whole humoral pathology fell into disgrace, and physicians, passing from one extreme of opinion to another, became pure solidists, as they were termed, whilst obvious and well ascertained facts became neglected.

But now that all exclusive views in physic have ceased, and that every organ, every texture, every fluid is subjected to careful observation, there is no doubt that many morbid changes will be discovered, not only in the blood, but in the other animal fluids, whether such as are provided for the nutrition, or such as are separated for the purification of the system. Indeed if any of these be morbidly affected, the blood itself must suffer by the addition of what is imperfect, or by the retention of what should be discharged. It is in this manner that impure air, and impure diet, and defective excretions of the fæces, urine, or perspirable matter, act in impairing the condition of the blood.

The first of the morbid changes which take place in the blood relates to its quantity. This may be excessive or deficient: the former state is denominated plethora, and will be treated of under that head; the latter condition constitutes the state of anæmia, of which an account has already been given. (See Plethora, Anæmia.)

The next changes in the blood relate to excess or deficiency in one or more of its constituent parts. The cruor, the serum, the colouring matter or hæmatosine, may each be too abundant or deficient. The same observation may be made in regard to the constituent parts of the blood viewed under a different aspect: the fibrine, the albumen, the saline ingredients may severally be augmented or diminished.

Other changes consist in the different manner in which the spontaneous separation of the cruor and serum takes place: sometimes this separation is very distinct; the cruor is firm and cupped, whilst the serum is fully pressed out and appears copious: in other cases the cruor is large and loose in its texture, involving a considerable quantity of serum, the portion pressed out being small: in a third case, in which the albumen appears to be in excess, this substance is separated, mingled with fibrine, and attached to the upper surface of the firm and cupped cruor, forming what is designated the buffy coat: in a fourth case the cruor is small, distinct in form, yet neither firm nor cupped, and floats in a serum of greater viscidity than usual.

A further series of changes consists in the defective coagulation of the blood, which remains more or less sanious, and is of various colours.

In other instances the blood appears to be deficient in hæmatosine as well as in fibrine and albumen. It is more or less deprived of colour and viscidity. Its cruor is of a salmon colour. Dropped upon white linen, it scarcely affords a tinge. This occurs especially in cases of protracted hemorrhage, and in chlorosis.

Besides the changes in the proportion of its different constituent parts, the blood frequently contains matter foreign to its healthy constitution, as pus, the encephaloid substance, entozoa, calculi. At other times the blood itself undergoes other changes, becoming grumous, sanious, &c.

That other changes still are induced in the blood, is proved by experiment. The morbid blood injected into the veins or cellular membrane of a healthy animal, immediately induces morbid or fatal effects. M. Gendrin introduced an ounce of the blood of a man affected with fever with gangrenous pustules, into the cellular membrane of the groin of a cat. Various symptoms followed, and the animal died in little more than six hours. The same effect was produced on injecting blood of the same patient into the crural vein of a dog. Similar results followed the similar injection of the blood of a patient affected with variola.

From these and similar facts it becomes quite obvious that the blood itself is morbidly affected in various diseases, as the worst forms of fever, variola, &c.

The blood may become morbid, not only from a deficient freshness of the air, and a deficient quantity of food, but from deleterious matters incorporated with the air or food. Contagious miasmata, malaria, may float in the atmosphere and corrupt the blood. Poisonous substances may be conveyed into the circulating system, more or less promptly, by means of the diet: many interesting facts of this kind are on record; but none is more so than the well-known influence of salt provisions in inducing scorbutus, and of the ergot in inducing a tendency to gangrene of the extremities.

The nervous system has also a direct influence upon the blood. In experiments in which the eighth pair of nerves has been divided, it is said that the venous blood is prevented from being changed into arterial (Dupuytren); that the blood even coagulates, and the fibrine and hæmatosine separate in the larger pulmonary arteries and veins (Mayer); and that arterial blood drawn from the carotid was deprived of a portion of its fibrine (Dupuy).

The same experiment, performed by M. Dupuy upon a horse, is said to have led to a dissolved state of the blood. Being injected into the veins of another horse, this blood is said to have induced gangrene.

Who, after reading these facts, will doubt that the humoral pathology has a solid basis in nature? It can, however, only be erected by observation and experiment, conducted with extensive views. Every inroad, every egress, every source of modification, physical or physiological, must be carefully taken into consideration in such an investigation.

§ 2. We shall now proceed to enumerate the various diseases in which changes in the blood are obvious enough to be placed beyond a doubt, yielding facts which may be added to science.

The first disease we shall mention is fever. There can be no doubt that the blood is variously affected in various kinds of fever. There can be little doubt that this affection of the blood is sometimes the *primary* affection. If this fact be established, the dispute whether fever be ever idiopathic, that is, independent of local disease, will be at an end.

Much information respecting the condition of blood in *fever* may be acquired from some of the more ancient authors, especially of what may be termed the observant sect, as Sydenham, Huxham, &c. The latter author describes the appearances of the blood of malignant fever thus: "The crasis of the blood is not sufficiently firm, too attenuated; the serum blackish or tinctured with red." (On the Air and Epidemics, vol. ii. p. 68.) In speaking of what he designates peripneumonic fevers, or in modern language, of fever complicated with pulmonary affection, he says, "The blood of such persons is always found too dissolved, although it is generally florid and specious, and for a long time preserves its serum; examine it at another time, and you will find the crassamentum livid and exceedingly dissolved, and swimming in a great deal of tawny, turbid, greenish, or reddish serum; again, at another time it is almost black and sanious, and not having the least cohesion." (Ibid. p. 202.) This appearance is contrasted with that of blood in pleuro-pneumony, in which it "was very thick and viscid, and on growing cold was covered over with a whitish, and as it were leather-like pellicle:" (p. 203.)

Such are still the appearances of the blood in various fevers, simple and complicated. But an entirely new series of observations is required, in order that the subject may be raised to the level of science in the other branches of medicine.

The morbid appearances of the blood in typhus fever have been particularly noticed by Dr. Tweedie, in his "Clinical Illustrations of Fever." He states, that in this class of fevers the crassamentum of the blood, instead of forming a firm coagulum, is loose, small in proportion to the quantity of serum, and so soft that it breaks readily on attempting to raise it, resembling in consistence half-boiled currant jelly; and that in some instances, when abstracted late in the disease, it scarcely coagulated at all.

The state of the blood in yellow fever has been lately particularly and ably brought before the profession by Dr. Stevens. (See Observations on the Blood: read at the College of Physicians, May 3, 1830.) Dr. Stevens observes—"On examining, soon after death, the black and dissolved blood that had been taken from the heart of those who had died of the yellow fever, it was very evident, even at first sight, that several great changes had taken place.

"1st. The blood was more fluid than natural, partly from an excess of serum, probably produced by a stoppage of the secretions and the retention of those fluids in the system, which ought to have been thrown out by the secreting organs; but independently of this, in these violent continued fevers, as little nourishment is used, the fibrine or solid part does not appear to be formed in its usual quantity, and perhaps, also, it is exhausted faster than in health, in supporting the high and continued excessive heat, that is so great in the commencement of the inflammatory form of that fever. In the first stage of the disease, the structure of the red globules is frequently deranged, which is evident from the fact, that in those fevers the colouring matter is often detached from the globules and dissolved in the serum, giving to that part of the blood, when it separates from the fibrine, a bright scarlet colour, and this colouring matter cannot be separated from the serum, either by filtration or any other mechanical means; but as the disease advances, this red colour is lost, and the whole circulating current becomes black, and so thin that it has no longer any resemblance to the blood of health.

"2d. The colour of the whole mass of blood, both in the arteries and veins, was changed from its natural scarlet, or modena red, to a dark black. I have frequently filled one glass with the black fluid taken from the heart, and another with the black vomit taken from the stomach. They were both so unlike the blood of health, and resembled each other so completely, that it was almost impossible to distinguish the one from the other; and from its appearance it was very evident that such diseased blood could no more stimulate the heart or support life in the solids, than putrid water can nourish vegetables, or carbonic acid gas support respiration.

"3d. In violent continued fevers, the saline matter, like the fibrine, appears to be exhausted faster than it enters the circulation; the blood soon loses a great proportion of its saline impregnation; it loses entirely its saline taste; and we shall afterwards see that the black colour is a certain proof of the entire loss, or at least of the great diminution of the saline matter.

"4th. The blood, though dissolved, was yet not putrid; for the blood is so essential to life, that putrefaction of this fluid cannot exist in a living body. But dissolution is the first step towards putrefaction; and when this to a certain degree takes place, death of all the solids must follow. I may here add, that this dissolved state of the vital fluid was the cause, and not the effect of death; for I have sometimes seen the blood, even previously to death, both black, and so thin that it could scarcely be retained within the vessels; and occasionally it has been observed oozing from the tongue, the eyes, the skin, and other surfaces, where there was not even the slightest lesion.

"The dissolved state of the blood is the effect and not the cause of fever. But as it was evident in many of the fatal cases, that this dissolution was the sole cause of death, it then became an object of importance to find out some agent capable of preventing this fatal change in the whole circulating current."

"In the Asiatic cholera, on the other hand, the blood becomes of an unnaturally dark colour and thick consistence."

Considerable changes are induced in the blood in *inflammation*. It is well known that the blood drawn in inflammation of the serous membranes is apt to be cupped and buffed; that is, the cruor is firm and contracted, and its edges are much raised above the central part of its surface; and its upper portion consists in a substance nearly deprived of colouring matter. This buff consists of fibrine and albumen; the serum contains more albumen than natural; and the crassamentum is exceedingly firm.

Is this modification of the blood the effect, or a cause, of the inflammatory process? That the blood may be cupped and buffed independently of inflammation, is proved by the facts of the occurrence of these phenomena in cases of pregnancy.

It is true, on the other hand, that the buffed and cupped state of the blood is not so obvious on the first day as on subsequent days, in cases of inflammatory disease. It must therefore be concluded that inflammation, and the state of pregnancy, and other sources of excitement, and even blood-letting itself, when so conducted as to lead to reaction, induce the cupped and buffy state of the blood.

It is an interesting fact to note, that the layers and adhesions formed upon or from the surfaces of inflamed serous membranes, are of the same chemical and physical constitution as that of the buff of the blood itself.

It is important to remark that it is not every kind of inflammation which induces the cupped form and buffy coat in the blood. Inflammation of the serous membranes and parenchymatous substance has chiefly this effect. Inflammation of the mucous membranes, as bronchitis, and dysenteria, frequently occurs without any disposition to a cupped or buffed condition of the blood. Indeed, there is a greater difference between these two classes of disease than their names would lead us to suspect.

Dr. Tweedie has observed, in two instances of acute disease, the buffy coat on arterial blood. The only reason why this appearance is not so familiar to us is, probably, the less frequent performance of arteriotomy than of venesection.

But besides the marked morbid appearances of the blood in fever and in inflammation, very peculiar changes take place in *chlorosis*. In this disease there is a general state of bloodlessness; the crassamentum is small, the proportionate quantity of serum large; a drop of the blood observed upon white linen is seen to be extremely pale. It still remains to ascertain the exact proportions of fibrine, albumen, hæmatosine, &c. in chlorotic blood, and to observe its appearance under the microscope. It still remains to compare it with the blood of persons blanched by hemorrhagy. The morbid character of the blood in chlorosis must be ranked amongst the most unequivocal proofs of the truth of a humoral pathology.

The next disease to be noticed in connexion with the pathology of the blood is *scorbutus*, the stronghold of the humoral pathologists,—the pons asinorum of the solidists. The defective cohesion and separation of the cruor, the "dissolved" state of the blood in scorbutus, could never be forgotten by either party; it was continually reproduced by the former, and pertinaciously neglected by the latter.

Dr. Mead gives a vivid description of the state of the blood in scorbutus. "In the beginning," he observes, (Medical Works, Dublin, 1767, p. 332,) "as it flowed out of the orifice of the wound, it might be seen to run in different shades of light and dark streaks. When the malady was increased, it ran thin, and seemingly very black; and after standing some time in the porringer, turned thick, of a dark muddy colour, the surface in many places of a greenish hue, without any regular separation of its parts. In the third degree of the disease it came out as black as ink; and though kept stirring in the vessel many hours, its fibrous parts had only the appearance of wool or hair floating in a muddy substance.

"In dissected bodies the blood in the veins was so entirely broken, that by cutting any considerable branch you might empty the part to which it belonged of its black and yellow liquor. When found extravasated, it was of the same kind. And lastly, as all other kinds of hemorrhage are frequent at the latter end of the calamity, the fluid had the same appearance as to colour and consistence, whether it was discharged from the mouth, nose, stomach, intestines, or any other part."

There is no point in pathology more instructive than this of scorbutus. The morbid influence of salt meat, and the curative influence of acids; the baneful effects of impure air and impure diet, and the beneficial effect of a change of atmosphere and regimen; are shown more clearly in this disease than in any other. And as subsequent links of the chain, the influence of a "dissolved" state of the blood in inducing a "dissolved" state of the solids, to use the ancient phraseology, is equally remarkable in this disease.

Nearly allied to scorbutus is *purpura*. Some singular appearances have been observed in the blood in this disease. The crassamentum has been found separated without being firm, or contracted; and buffed without being cupped; its upper surface covered to a considerable depth by a straw-coloured substance resembling ordinary jelly. This, as well as the other parts of this interesting subject, still needs further investigation.

As an improper kind of diet produces a baneful influence upon the composition of the blood, so does a disordered and *loaded state of the bowels*. This is apparent from the condition of the secretions: the saliva, the perspiration, the urine, are alike deranged in their obvious qualities, but especially in odour; and there is more or less of the bloodless appearance seen in chlorosis.

Icterus is another disease in which the blood is known to suffer. The colouring principle, at least, of the bile is retained in the blood. It appears to act as a narcotic upon the brain, inducing drowsiness. The serum of the blood and the secretions from the skin and kidney are in some cases alike tinged with the yellow colouring matter of the bile.

Every one knows the baneful influence of a suppressed state of another secretion—*the urine.* It cannot be doubted that some of the principles of this secretion are retained in the blood. Prévost and Dumas found urea in the blood of an animal in which the ureters had been tied. In the human subject, suppression of the urine, or the presence of some of its principles in the blood, produces coma and death.

M. Dance has recently renewed the idea of a former day, that the suppression of the secretion of milk may, like that of the bile or urine, affect the blood and the secretions. In one such case it is said that caseum was found in the fluid of ascites, evacuated from the abdomen.

But if the secretions become sometimes suppressed, and produce a reflex alteration in the blood, there is a case in which the blood becomes morbidly affected, together with an excessive secretion, as in diabetes. The blood in this disease is more serous, and contains less fibrine than usual. It would be interesting to examine the effect upon the blood of excessive perspiration, undue lactation, and profuse or protracted menorrhagia or leucorrhœa.

The facts which result from this inquiry are these:—1. In many diseases, as fever, inflammation, chlorosis, scorbutus, there are undoubted morbid changes induced in the blood itself; 2. that other morbid changes are induced by impure atmosphere and an unwholesome diet; 3. that various miasmata in the atmosphere, and various poisonous qualities in food, produce morbid changes in the blood; 4. that suppressed secretions induce morbid changes in the blood; 5. that excessive secretions induce other morbid changes in this fluid; and, 6. that an affection of the innervation, or of the nervous system, may, as is observed on a division of the eighth pair of nerves, produce its peculiar changes in the circulating mass.

The practical indications resulting from these and other morbid states of the blood will be noticed under the head of diseases in which they chiefly are found. We consider their statement in this place as highly important in a practical point of view.

MARSHALL HALL.

[*Hæmatology*, or the examination of the blood, has engaged the attention of many excellent observers of late years, and with much advantage to science. When the blood is circulating in the vessels it consists of a homogeneous fluid, to which Dr. B. Babington (*Cyclopædia of Anat. and Physiol.* vol. i. p. 415, Art. *Blood, morbid conditions of the*) has given the name *Liquor Sanguinis*, and of Red Corpuscles. The difference between living and coagulated blood may be expressed in a tabular form as follows:

Living Blood.	*Liquor Sanguinis*,	Water,	*Serum.*	Coagulated Blood.
		Various Salts,		
		Fatty Matter,		
		Extractive do.,		
		Albumen,		
		Fibrin,	*Crassamentum.*	
	Red Corpuscles.			

The analysis of the blood by M. Lecanu is generally regarded the most complete that has been made (*Journal de Pharmacie*, vol. ix. & x, Paris, 1831, and H. Milne Edwards, Art. *Blood*, in *Cyclop. of Anat. and Physiol.*, vol. i. p. 411.) The careful examination of the blood of two strong and healthy men afforded the following results:

	1st Analysis.	2d Analysis.
Water	780.145	788.590
Fibrin	2.100	3.565
Albumen	65.090	69.415
Colouring Matter	133.000	119.626
Fatty crystallizable Matter	2.430	4.300
Oily Matter	1.310	2.270
Extractive Matters soluble in alcohol and in water	1.790	1.920
Albumen combined with Soda	1.265	2.010
Chloride of Potassium	8.370	7.304
Chloride of Sodium		
Alkaline Subcarbonates		
Alkaline Phosphates		
Alkaline Sulphates		
Subcarbonate of Lime	2.100	1.414
Subcarbonate of Magnesia		
Phosphate of Lime		
Phosphate of Magnesia		
Phosphate of Iron		
Peroxide of Iron		
Loss	2.400	2.586
Total	1000,000	1000,000

A long series of connected hæmatological observations has been made by M. Andral, both alone and in association with M. Gavarret and M. De La Fond (*Annales de Chimie et de Physique*, tom. lxxv. & 3mè série, tom. v. and *Hématologie Pathologique*, Paris, 1843), which have developed interesting results. Their inquiries were directed to the variations in the proportion of certain principles of the blood, as the fibrin, corpuscles, solid matters of the serum and water, both in the healthy and morbid state. The method adopted for this purpose was as follows:—The blood was made to flow into two different vessels. Into one, the first and last quarters of the blood were received; and into the other the second and third quarters; in order that the similarity of the two quantities might be attained as far as practicable. The blood in one vessel was permitted to coagulate spontaneously;—that in the other vessel was beaten with a small rod in order to separate the fibrin. When the first portion had completely coagulated, the serum was carefully separated from the crassamentum; and they then dried and weighed, *first*, the fibrin obtained by the rod; *secondly*, the whole crassamentum; *thirdly*, the serum. The weight of the separated fibrin gave the quantity of it contained in the clot. The weight of the serum after complete desiccation gave the proportional quantity of solid matter contained in its water. The quantity of water driven off from the clot in drying gave the amount of serum it contained; from which the proportion of the solid matter of the serum that the crassamentum contained could be estimated. Hence, by deducting from the weight of the whole dried clot, first, that of the fibrin separated by agitation, and then that of the solid elements of the serum, ascertained by calculation, the weight of the red corpuscles was obtained. In order to ascertain the whole amount of solid matter in the serum, that which was ascertained by calculation to exist in the fibrin was added to that which was obtained from the separate serum. The proportion of inorganic and of organic matter in this solid residuum was ascertained by incinerating it in a crucible; by which the whole of the former was driven off, whilst the latter was left.

These researches have shown, that the average amount of fibrin in human blood is 3 parts in the 1000. In persons in health, the amount of fibrin may oscillate around this average so as to descend as low as 2.5; or ascend as far as 3.5; without actual disease existing. M. Andral, indeed, (*Hématologie*, &c. p. 28.) affirms, that some individuals, without being sick, have the ratio as high as 4; whilst others have it as low as 2; but these are rare cases, and belong to peculiarities of constitution or to idiosyncrasies.

The average quantity of red corpuscles in healthy man was found to be 127; the maximum being 140; and the minimum 110. The maximum 140 is, however, according to M. Andral, associated with a state of plethora, which, when developed, is really morbid. Strength of constitution contributes most to raise the corpuscles towards their maximum, whilst congenital, or acquired weakness, depresses them towards their minimum. The average proportion of the solid matter of the serum was found to be 80. It, also, is liable to variation within certain limits in the state of health; but whenever it passes those limits, disease exists.

The results of the observations of recent hæmatologists, in special diseases, will be given under those diseases.

ROBLEY DUNGLISON.]

BLOODLETTING. The detraction of blood is either *general* or *topical*: the first consists of phlebotomy or venesection, and of arteriotomy: the second, of leeching, cupping, and scarification.

As general bloodletting is, of all our remedies, the most powerful, its employment requires the utmost consideration and precaution. If we neglect this remedy in cases in which its use is required, we allow the disease to make a dangerous progress; on the other hand, if we employ it inadvertently and inappropriately, we induce a dangerous state of debility or exhaustion. It will, therefore, require much care to lay down such rules as may guide, or, at least, assist the young practitioner in the due and efficient, but appropriate and cautious, use of bloodletting.

Of the circumstances which require consideration in the prescription or performance of bloodletting, the principal are, 1. the nature and stage of the disease; 2. the velocity and the force of the action of the heart; 3. the condition of the pulse at the wrist; 4. the appearance of the blood; and, 5. the effect upon the patient, in arresting the symptoms, subduing the disease, or in inducing syncope. In regard to the repetition of the bloodletting, the same circumstances must be considered, in conjunction with the actual state of the symptoms, the appearances of the blood previously drawn, &c.

The diseases which require bloodletting are chiefly inflammation, diseases of the head, and some forms of fever. Of the first class it is remarked, that inflammations of the serous membranes and of the substance of organs require bloodletting much more than inflammations of the mucous membranes: arachnitis, pleuritis, peritonitis, pneumonia, hepatitis, require general bloodletting far more than bronchitis or dysentery. The second class, or affections of the head, consist either of inflammatory, congestive, or organic disease, as arachnitis, apoplexy, tumours; or of what may be termed affections of nervous irritability, such as are observed from intestinal derangement, exhaustion, &c. and in delirium tremens, the delirium traumaticum described by M. Dupuytren, &c. Now the diseases of the former of these subdivisions require bloodletting proportioned to their severity; whereas in those of the latter the detraction of blood requires great caution.

Laennec assures us that the force of the beat of the heart under the stethoscope is an excellent criterion and guide for the use of the lancet. As this point does not appear to have excited further attention, it will be especially proper to introduce the remarks of that eminent pathologist in this place: "In all cases in which the pulsations of the heart are, proportionately, more energetic than those of the arteries, we may bleed fearlessly and be certain of an improvement in the state of the pulse. But if the heart and the pulse be alike feeble, bloodletting will almost always precipitate the patient into a state of complete prostration." (De l'Auscultation, t. i. p. 486–7.) Laennec adds, (T. ii. p. 481.) "the certainty and facility with which the stethoscope affords or excludes the indications for bloodletting, appears one of the greatest advantages conferred by this instrument."

It must be confessed, however, that as the pulse may be "*fictitie debilis*," or apparently, not really, a mark of weakness, so the beat of the heart may be apparently, rather than really, strong; this occurs in cases of mere nervousness, and in one stage of exhaustion. But in the instances from which such sources of error are excluded, it is plain that an attention to the force of the beat of the heart may be of the utmost advantage.

The condition of the pulse is also one of those circumstances which greatly assist us in the administration of bloodletting. But that we may derive all the advantage possible from the state of the pulse, it must always be considered in connexion with the disease. Thus in enteritis, although an inflammatory disease, the pulse is small and feeble, and would not to the inexperienced suggest the propriety of the essential remedy, bloodletting; in a certain stage of exhaustion from loss of blood, on the other hand, the pulse is bounding and strong, and the ignorant or incautious practitioner might be led by it to an improper and unsafe detraction of blood. Still the pulse, taken in this connexion, is an important guide to us for the use of the lancet; its strength indicating, its feebleness contra-indicating, the detraction of blood.

[Mere quickness of pulse—taken singly—can never be regarded as a positive indication for the use of the lancet, inasmuch as it occurs in diseases which are highly neuropathic, and especially where they are accompanied at the same time by debility; and the practitioner who expects, under such circumstances, to diminish the velocity of the circulation by bloodletting, will find himself wofully mistaken. In scarlatina, quickness of pulse is one of the most marked functional phenomena, and in the most malignant cases this is often most strikingly evinced; yet bloodletting can rarely be employed in such cases, and if it should be, it will generally be found, that the quickness of pulse is increased rather than diminished by it. (See, on the whole subject of Bloodletting, Dunglison's *General Therapeutics and Materia Medica*, ii. 150: Philad. 1843.)]

During the flow of blood itself, great attention must be paid to the state of the pulse; if it grow larger, fuller, stronger, the propriety of taking more blood is distinctly determined; if, on the contrary, it becomes feebler, the further flow of blood must be arrested.

In some cases the blood flows well, and displays only a proper degree of the venous hue; in other cases it flows tardily or scarcely at all, and is of an unusually deep livid hue. The former state of things affords an indication of the propriety of proceeding with the detraction of blood; the latter warns us of the necessity for the greatest caution in regard to this measure. This distinction has been recently particularly insisted on in regard to fever by Dr. Tweedie, in his work on that subject.

It sometimes occurs, however, that the blood flows ill at first, and better shortly afterwards. This is particularly observed in those cases which are attended by a small pulse, and a cold, livid surface, as enteritis. This improvement in the flow of the blood from the vein must be viewed as an indication of the propriety of allowing the blood to flow on.

A change in the appearance of the blood, as it flows, from the more livid to the less livid hue, must also be considered as indicating the propriety of the still further detraction of blood.

The effect of the flow of blood upon the patient is also to be strictly attended to. If pain for instance, or any other symptom of an inflammatory disease, remain unsubdued, it is frequently right to continue the abstraction of blood. If, whilst the strength is good, stupor in apoplexy, or pain in pleuritis, remains unmitigated, the blood must be allowed to flow. When, on the contrary, the disease or the symptom is alleviated or removed, we are frequently to arrest the flow of blood, and to wait and watch the subsequent state of the patient and of the symptoms; to repeat the bloodletting if the symptoms return and the strength of the patient remain good, and vice versâ.

But of all the criteria for the regulation of general bloodletting, the effect of the detraction of blood upon the patient, in inducing syncope, is, in our opinion, the most important. The principle of this criterion is only applicable in cases in which it has been previously judged right to recommend the full effect of bloodletting; but in such cases it appears to afford the precise measure to which that bloodletting should be carried.

The principle alluded to may be stated thus: —1. *cæteris paribus*, some diseases enable the system to bear a greater loss of blood than in health: 2. other diseases, on the contrary, induce an unnatural susceptibility to the effects of loss of blood: 3. these two points are severally established by placing the patient *perfectly* upright, and letting blood from a moderate-sized orifice until *incipient* syncope be induced, the quantities of blood which flow denoting the power or the susceptibility of the patient in regard to the loss of blood: 4. this effect is also accurately indicative of the quantity of blood which should be abstracted in order to subdue the disease.

It is found, for instance, that in arachnitis and apoplexy much blood flows before there is any symptom of approaching syncope: it is also well known that it is necessary to abstract much blood in these diseases before the chain of morbid actions can be broken. It is probably not so well known that these two facts are precisely commensurate with each other; so that to bleed to incipient syncope is to bleed precisely according to the exigencies of the case.

Pleuritis and pneumonia not only require, but enable the patient to bear the abstraction of a large quantity of blood: bronchitis, on the other hand, neither bears nor requires much loss of blood. In any case, if we place the patient upright and bleed to incipient syncope, we abstract precisely the quantity of blood which the patient will bear to lose, and which the disease requires to be withdrawn.

Similar remarks apply to peritonitis, and what has been termed muco-enteritis.

In other cases there is a difficulty in the diagnosis, and there may be symptoms resembling arachnitis, pleuritis, peritonitis, without inflammation: such symptoms are apt to arise merely from a loaded and deranged state of the stomach or of the bowels; some indigestible substance taken under circumstances of susceptibility, as in the puerperal state; the presence of scybala, or unhealthy secretions. The intestines, under similar circumstances, induce pain and affections of the head or abdomen so similar to inflammation, as not easily to be distinguished from it. In such cases we may, however, safely place the patient erect, and bleed to incipient syncope. Whereas in arachnitis we frequently abstract thirty, forty, or fifty ounces of blood, or even a still greater quantity,—in these cases the loss of ten, twelve, or fourteen ounces will frequently induce the most decided syncope.

We are thus furnished at once with the due measure of the remedy and the diagnosis of the disease.

The same rule applies in the early stage of fever, in which, if there be great constitutional power and excitement, or inflammation, much blood must and will be drawn; whereas, in cases of an opposite kind, there will be early syncope —our safeguard against withdrawing an undue quantity of blood.

Having stated and explained the general principle, it only remains to add that several precautions are required in carrying it into practice. We must not be deceived by that kind of fainting which occurs from timidity in regard to the mere operation. We must not be misled by the state of things very early and very late in the disease.

In the former case the disease has not induced its influence upon the system; in the second it has led to sad devastation of its powers, as well as of the structure of the organ affected.

Chlorosis and every form of dyspepsia are amongst the diseases which neither bear nor require bloodletting.

There are diseases which may be benefited by the detraction of a small quantity of blood, but in which full bloodletting would not be proper. Such are, some cases of hæmoptysis, diabetes, and probably the cholera. In regard to these, experience of the past alone can guide us in the future. The principle just adverted to is only applicable in cases in which the full effects of bloodletting are required, not exceeding the limits of efficiency on one hand, and of safety on the other.

The next point to be determined is the repetition of the bloodletting. The strength of the patient, the force of the symptoms, the beat of the heart and of the pulse, must again aid us in our decision. But it is important to remark, that if at the first bloodletting much blood should flow before syncope is induced, it must be received as a criterion that the disease may require, as the patient will bear, the early and efficient repetition of the remedy.

Much importance has been attached to the appearance of buff upon the blood, as an indication for further bloodletting. This appearance, however, if trusted to alone as a guide, is very apt to mislead the practitioner. It occurs in many other cases besides inflammation, and especially in almost all puerperal diseases. A patient has been daily bled in puerperal mania, on accouut of the constant appearance of buff on the blood, and bled to death! Dr. Willan makes an excellent remark on this subject. "Some practitioners," he observes, "continue to let blood in most cases of acute rheumatism, thinking themselves justified in their mode of practice by the sizy appearance of the blood. The same principle would lead them to empty the whole sanguiferous system; for every time bloodletting is repeated, the blood becomes more and more dense or sizy." (Diseases of London, 1821, p. 261.) Not only is buff induced by other causes besides inflammation, but in some cases of inflammation it does not exist. Much, too, depends upon the mode in which the blood flows from the vein, and other circumstances. So that the light cast upon the treatment of diseases by this circumstance is feeble, if not actually deceptive.

The "dissolved" state of the blood, and the small quantity of crassamentum compared with the serum, form a more certain contra-indication of bloodletting, generally speaking; and yet even this is probably not absolute.

The different modes of general bloodletting are venesection, performed in the arm or foot, or in the neck; and arteriotomy.

It is almost needless to mention that the arm is generally preferred. The jugular vein, however, should be opened when the head is affected. But it is principally useful to have recourse to the incision of the jugular vein in children, in whom it is readily opened, and in whom the veins of the arms are small.

Arteriotomy is preferred principally in cases of disease of the head or of the eye, or in cases in which blood cannnot be obtained from the veins.

Local bloodletting is chiefly applicable as an auxiliary to general bloodletting, and in local diseases in which general bloodletting is not required. In cases of inflammation within the head, chest, or abdomen, after the due abstraction of blood generally, the local abstraction of blood is very often employed most opportunely. The second remedy secures the benefit which the first had conferred. In regard to the application of a large number of leeches in such cases, a few words of caution are, however, necessary. The loss of the blood so withdrawn is not always well borne when the lancet has been used efficiently just before; and if applied late at night, the flow of blood is apt to continue unheeded, until an undue quantity of blood has been poured out. Both these events have occurred, and led to unavailing regret.

Cupping is, generally speaking, a more efficient remedy than leeching. It is most appropriately applied to the nape of the neck, behind the ears, to the temples, to the various parts of the chest, over the region of the liver, the kidney, &c. To the softer parts of the abdomen, leeches must be applied.

Both these remedies are peculiarly efficacious in cases in which the powers of the whole system have been duly subdued by general bloodletting, without the removal of the symptoms of the local disease. Only the quantity so withdrawn after the general bloodletting must not be too great.

In some chronic local affections, in which general bloodletting would be inadmissible, the local abstraction of blood by leeches or cupping becomes our chief remedy. Such cases are chronic inflammation within the head, thorax, or abdomen; especially when this is fixed chiefly to one part or organ. Inflammatory pain long confined to one part of the head or chest, chronic inflammation of the liver, kidney, uterus, &c. are cases in which local bloodletting is the appropriate remedy.

It should not be omitted, perhaps, that the application of leeches near the anus has been much recommended in France, in order to effect what is supposed to be effected by hemorrhoidal discharges, viz. to unload the vena portæ, and to relieve the head or the liver. This mode of local bloodletting is also very beneficial in diarrhœa and dysentery. Leeches have also been applied by means of an appropriate metallic tube to the vagina or to the os uteri, in cases of inflammation of those parts.

These appear to be appropriate cases for the use of local bloodletting by cupping and leeches. Scarification is a mode of taking blood in a few cases of local disease, as in inflammation of the eye, of the tonsils, and in inflamed hemorrhoids.

Morbid Effects of loss of Blood.—The morbid effects of loss of blood may be divided into the *immediate* and the *more remote:* the former occur at the moment of the excessive detraction of blood or of profuse hemorrhagy; the latter, at a more remote period, or during the course of a continued drain from the sanguiferous system. The immediate morbid effects of loss of blood are, syncope, convulsion, delirium, coma, sudden dissolution; the more remote are, excessive re-action, mania, coma, amaurosis, sinking.

In ordinary syncope from loss of blood, the patient first experiences a degree of vertigo, to which loss of consciousness succeeds; the respiration is affected in proportion to the degree of insensibility, being suspended until the painful sensation produced rouses the patient to draw deep and repeated sighs, and then suspended as before; the beat of the heart and of the pulse is slow and weak; the face and general surface become pale, cool, and bedewed with perspiration; the stomach is apt to be affected with eructation or sickness. On recovery there is perhaps a momentary delirium, yawning, and a return of consciousness; irregular sighing breathing, and a gradual return of the pulse.

In cases of profuse hemorrhage the state of the patient varies: there is at one moment a greater or less degree of syncope, then a degree of recovery. During the syncope the countenance is extremely pallid; there is more or less insensibility; the respiratory movements of the thorax are at one period imperceptible, and then there are irregular sighs; the pulse is slow, feeble, or not to be distinguished; the extremities are apt to be cold; the stomach is frequently affected with sickness. There are several phenomena observed in this state particularly worthy of attention. We have remarked that, when the movements of the chest have been imperceptible or nearly so, in the interval between the sighs, the respiration has still been carried on by means of the diaphragm. It may also be observed that the state of syncope is often relieved, for a time, by an attack of sickness and vomiting, immediately after which the patient expresses herself as feeling better; and the countenance is somewhat improved, the breathing more natural, and the pulse stronger and more frequent. It may be a question, in this case, whether the state of syncope increases until it induces sickness; or whether the stomach be nauseated by the ingesta usually administered, and the syncope be, in part, an effect of this state of the stomach. In any case, the efforts to vomit are succeeded for a time by an ameliorated state of the patient.

In cases of fatal hemorrhagy there are none of these ameliorations. The symptoms gradually and progressively assume a more and more frightful aspect: the countenance does not improve, but becomes more and more pale and sunk; the consciousness sometimes remains, until at last there is some delirium; but every thing denotes an impaired state of the energies of the brain; the breathing becomes stertorous, and at length affected by terrible gasping; there may be no efforts to vomit; the pulse is extremely feeble or imperceptible; the animal heat fails, and the extremities become colder and colder in spite of every kind of external warmth; the voice may be strong, and there are constant restlessness and jactitation; at length the strength fails, and the patient sinks, gasps, and expires.

Convulsion, as an immediate effect of loss of blood, occurs when bloodletting has been inappropriately or unduly employed, or from excessive hemorrhage. It is apt to occur in cases in which the patient has been bled in a more or less recumbent position, in which the blood has flowed slowly, or in which time has been lost during the operation. In such cases much blood flows before syncope is induced — too much to be safe. When the blood flows slowly, we should be cautious how we bleed to deliquium even in the erect posture; in the recumbent posture it will always be attended with danger.

The more usual occurrence of convulsions is from hemorrhagy. In this manner such convulsions occur after parturition, and constitute one form of puerperal convulsions. A more frightful and formidable disease it is impossible to witness. The countenance and the limbs are variously contorted, the respiration is laborious and stertorous, and foam issues from the mouth; the colour of the face is deepened, and may be designated as being of a palish lividity. Such a case calls for the utmost presence of mind. The alarm of the by-standers must be quieted. No hasty measures must be adopted. The recumbent posture, the sprinkling of cold water upon the face, a cold lotion applied to the head, and frictions to the feet, are the immediate remedies; stimuli and opiates, with nourishment, are to be administered during the intervals of convulsion.

Sometimes, instead of convulsions, a fit of delirium occurs; in other, rarer, cases, we may have both delirium and convulsions. This delirium is generally of short duration; it has, in other instances, continued so long as to deserve to be considered as mania. A state of coma is another form of the morbid effects of loss of blood. Convulsion frequently terminates in coma, but the latter symptom may arise without the former.

Of these effects of loss of blood, delirium chiefly occurs in adult age; convulsions frequently occur both in adults and in infants; the state of coma is most frequent in infancy. The last case constitutes one of those affections which are apt to be mistaken for hydrencephalus.

Amongst the immediate effects of loss of blood must be mentioned that of sudden and unexpected dissolution. The patient does not recover from a state of syncope; or, without syncope, he may gradually sink after blood-letting. This event is particularly apt to occur if the patient be bled in the recumbent position. It has taken the most able and experienced practitioners by surprise.

At various periods after the profuse loss of blood, whether by bloodletting or hemorrhagy, that state which has been termed re-action occurs. This state of excessive re-action is formed gradually, and consists, at first, in forcible beating of the pulse, of the carotids, and of the heart, accompanied by a sense of throbbing in the head, of palpitation of the heart, and eventually perhaps of beating or throbbing in the scrobiculus cordis, and in the course of the aorta. This state of re-action is augmented occasionally by a turbulent dream, mental agitation, or bodily exertion. At other times it is modified by a temporary faintness or syncope. There is also sometimes irregularity of the beat of the heart and of the pulse.

In the more exquisite cases of excessive re-action, the symptoms are still more strongly marked, and demand a fuller description.

The beating of the temples is at length accompanied by a throbbing pain of the head, and the energies and sensibilities of the brain are morbidly augmented; sometimes there is intolerance of light, but still more frequently intolerance of noise, and of disturbance of any kind, requiring stillness to be strictly enjoined, the knockers to be tied, and straw to be strewed along the pavement; the sleep is agitated and disturbed by fearful dreams, and the patient is liable to awake, or to be awoke, in a state of great hurry of mind, sometimes almost approaching to delirium; sometimes there is slight delirium, and occasionally even continued delirium; more frequently there are great noises in the head, as of singing, of crackers, of a storm, or of a cataract; in some instances there are flashes of light; sometimes there is a sense of great pressure or tightness in one part or round the head, as if the skull were pressed by an iron nail, or bound by an iron hoop.

The action of the heart and arteries is morbidly increased, and there are great palpitation and visible throbbings of the carotids, and sometimes even of the abdominal aorta, augmented to a still greater degree by every cause of hurry of mind or exertion of the body, by sudden noises or hurried dreams or wakings; the patient is often greatly alarmed and impressed with the feeling of approaching dissolution; the state of palpitation and throbbing is apt to be changed, at different times, to a feeling of syncope. The effect of sleep is in some instances very extraordinary, sometimes palpitation, at other times a degree of syncope, or an overwhelming feeling of dissolution. The pulse varies from 100 to 120 or 130, and is attended with a forcible jerk or bounding of the artery.

The respiration is apt to be frequent and hurried, and attended with alternate panting and sighing; the movement of expiration is sometimes obviously and singularly blended with a movement communicated by the beat of the heart; the patient requires the smelling-bottle, the fan, and the fresh air.

The skin is sometimes hot; and there are frequently general hurry and restlessness.

In this state of exhaustion, sudden dissolution has sometimes been the immediate consequence of muscular effort on the part of the patient, or of his being too suddenly raised from the recumbent into the erect position.

The state of re-action may gradually subside and leave the patient feeble, but with returning health; or it may yield to the state of sinking. This term is adopted not to express a state of negative weakness merely, which may continue long and issue in eventual recovery, but to denote a state of positive and progressive failure of the vital powers, attended by its peculiar effects, and by a set of phenomena very different from those of exhaustion with re-action. In the latter the energies of the system were augmented; in the former the functions of the brain, the lungs, and the heart are singularly impaired. The sensibilities of the brain subside, and the patient is no longer affected by noises as before; there is, on the contrary, a tendency to dozing, and gradually some of those effects on the muscular system supervene which denote a diminished sensibility of the brain, as snoring, stertor, blowing up of the cheeks in breathing, &c. Instead of the hurry and alarm on awaking observed in the case of excessive re-action, the patient in the state of sinking requires a moment to recollect himself and recover his consciousness, is perhaps affected with slight delirium, and is apt to forget the circumstances of his situation, and, inattentive to the objects around him, to fall again into a state of dozing.

Not less remarkable is the effect of the state of exhaustion with sinking on the function of the lungs; indeed, the very first indication of this state is to be found in the supervention of a crepitus in the respiration, only to be heard at first on the most attentive listening; this crepitus gradually becomes more audible, and passes into slight rattling, heard in the situation of the bronchi and trachea; there is also a degree of labour or oppression, sighing, hurry, blowing, in the breathing, inducing acuteness in the nostrils, which are dilated below, and drawn in above the lobes at each inspiration; in some cases there is, besides, a peculiar catching laryngeal cough, which is especially apt to come on during sleep, and awakes, or imperfectly awakes, the patient. The heart has, at the same time, lost its violent beat and palpitation, and the pulse and arteries have lost their bounding or throbbing. The stomach and bowels become disordered and flatulent, and tympanitic, and the command over the sphincters is impaired.

The last stage of sinking is denoted by a pale and sunk countenance, inquietude, jactitation, delirium, and coldness of the extremities.

It has already been observed that delirium occurs as an immediate effect of loss of blood: mania, or delirium in a more or less continued form, is not an unfrequent occurrence, as a more remote effect of the same cause. That form of this disease termed *puerperal mania*, generally arises from the loss of blood in the predisposed. A form of mania, not to be distinguished, except by the history of the case, from puerperal mania, occurs from loss of blood, independently of the circumstance of parturition.

Coma, amaurosis, deafness, and paralysis are other forms of the effects of loss of blood. Cases of the first kind are detailed by Dr. Abercrombie as well as by the writer of this article. Mr. Travers describes a form of amaurosis from depletion. Deafness from exhaustion is by no means unfrequent; and it occasionally remains for a considerable length of time. Paralysis, more or less permanent, occurs occasionally in extreme cases of exhaustion.

Various circumstances exert an influence in diminishing or augmenting the disposition to present the phenomena of loss of blood. Inflammation of the serous membranes and of the parenchymatous substance of organs protects the system from the effects of loss of blood; gastric and intestinal derangements have a precisely contrary effect. It is probable that the mode in which these circumstances operate is that of inducing different states of the blood itself: inflammation is known to increase the quantity of albumen in blood, and in general to induce the disposition to buff; chylopoietic derangements, on the contrary, induce an opposite condition of the blood. In the former case the arterial system is probably more firmly contracted upon its contents, even when a part of these is subtracted; and in this manner the disposition to syncope and to the other effects of loss of blood may be obviated.

Besides the affections described, there are some organic effects from loss of blood. There is a disposition to effusion within the head, so that actual apoplexy as well as serous effusion has occurred in the last stage of exhaustion. Another effect of exhaustion is effusion into the air-cells and bronchi, giving origin to a peculiar rattle heard with the stethoscope, and generally of fatal omen. Tympanitis is another effect of loss of blood; and a general disposition to dropsy, internal and external, is amongst the most frequent of the effects of this condition of the system.

The treatment of the effects of loss of blood must be resolved into that which is general or constitutional, and that which is local; and it must vary according to the peculiar state or stage of these effects. Syncope, re-action, and sinking require their appropriate treatment. The constitutional treatment must be stimulant in syncope, sedative and soothing in the state of re-action, and restorative in that of sinking. The local treatment must vary with the organ chiefly affected, and with the mode in which it is affected.

When syncope assumes a dangerous form, the principal remedies are, an attention to the posture of the patient, stimulants, and chiefly brandy, and the transfusion of blood.

The effect of posture is not, even now, fully known. It would be easy to allow the patient to lie over the edge of the bed, the head low upon the floor, and the feet gently raised. In this manner such pressure would be restored to the encephalon as would in many cases support life, until, other remedies being administered, the patient might be placed out of immediate danger. We need not in this place notice the importance of a regulated mode of giving brandy and nourishment. We think it is frequently given in such quantities as actually to induce sickness and its own rejection from the stomach, and so as to frustrate the object of the physician completely. The effect should be carefully watched. The physician ought not, of course, in such a case, to leave the patient for a moment.

The next remedy is transfusion. Unfortunately it has too frequently happened that the proper period of adopting this measure has been allowed to pass by. Not only the vascular system is exhausted, but, after a time, the functions of the nervous system have begun to fail. It might be a question, therefore, whether galvanism might not be usefully conjoined with transfusion.

It is an important point to determine how large a quantity of blood the system will bear to receive under various circumstances of exhaustion. Too much may overwhelm; too little may be inadequate to the accomplishment of the object in view. It is also an important question whether the operation should be done at once, or at twice, or thrice, and with what intervals. As the system cannot bear a sudden reduction of the quantity of blood, so it may not be enabled to bear its too sudden restoration. It is almost needless to add that a due attention must be constantly paid to assist the arterialization of the blood by the admission of fresh air; and to sustain the animal heat by proper clothing, and especially warm applications to the feet.

If there should be convulsions, delirium, or coma, it may be necessary to apply a sinapism to the nape of the neck; and in the two former cases some mild sedative, as the tinctura hyoscyami, may be of advantage.

In the case of excessive re-action, the remedies appear to be, first, extreme quiet of body and of the mind; then, the mildest sedatives, especially the hyoscyamus; thirdly, the mildest nutriments; and lastly, and above all, time.

The pain and throbbings in the head, the intolerance of noises, the general susceptibility to disturbance, the palpitations of the heart, alike demand the utmost quiet, to which every thing soothing in the manner and treatment must be added. The tinctura hyoscyami is, we think, the kindliest anodyne and sedative in these cases. The cause and other circumstances of the case point out the necessity for mild nutriment, to which perhaps the minutest quantities of brandy may be added.

It may be necessary to subdue the throbbing action of the head even by local bloodletting; and it is most remarkable how small a quantity of blood being taken will relieve. Two or three leeches are frequently quite sufficient.

But the most unequivocal remedy is a cold spirituous lotion, applied all over the head by means of a cap consisting of one fold of stocking.

In exhaustion with delirium, the tinctura hyoscyami should be conjoined, in full doses, with the other remedies. The morbid susceptibility, not only of the brain but of the heart, is greatly assuaged by this remedy.

In cases of exhaustion with sinking, stimulants must be administered abundantly. Cataplasms of mustard may be applied to the nape of the neck and to the feet. It is difficult to imagine what would be the effect of a transfusion of blood; we have no doubt that galvanism would prolong life; and we should think the two remedies might be conjoined with advantage.

In all cases of exhaustion the functions of the bowels suffer. Constipation and flatulency are the usual consequences. These are best relieved by the warm water enema, which must, however, of course, be administered with due precaution, so as to prevent further exhaustion.

It is interesting to observe the blunted sensibilities in syncope and in sinking, and to compare them with the morbidly acute sensibilities of the state of re-action. Sinapisms to rouse, and the tinctura hyoscyami to lull them, are, in their respective places, remedies of the greatest value.

Marshall Hall.

BLUE DISEASE. (See Cyanosis.)

BRAIN, Inflammation of the.—Under this term we propose to include the pathology, symptoms, and treatment of the inflammatory affections of the brain and of its membranes. We adopt this plan, not merely because of the intimate relation subsisting between these structures, but because, when we trace the history of a number of acute affections of the encephalon, and examine the lesions of structure presented after death, we shall frequently find that the substance of the organ as well as the investing membranes has been involved in the disease. Hence arises the difficulty of establishing the diagnosis between inflammation of the parenchyma of the brain and that of its membranes. Both forms of disease have been classed by the majority of nosologists, ancient as well as modern, under the same head as *phrenitis*, in consequence of their inability to draw any distinct line of demarcation between their symptoms.

Several modern pathologists, however, (Lallemand, Rostan, Bouillaud, Gendrin, &c.) having devoted much time and attention to the study of cerebral diseases, and collected a large body of well-observed clinical cases, conceive that they have succeeded in establishing correct rules of diagnosis between several of the inflammatory affections of the brain and of its membranes; and they affirm, moreover, that it is quite possible, in many cases, to ascertain the different degrees, stages, and even seats of cerebral inflammation. The rapid advances made of late years in the knowledge of the physiology and morbid anatomy of the brain, have no doubt greatly assisted modern observers in discriminating the characters of its various diseases. It is not, in the mean time, improbable that they may, in some instances, have been led, by their zeal in a new field of discovery, to overstep the exact boundaries of fact. We think there is, however, an equal probability that many of our failures in diagnosis, in a class of diseases hitherto so little studied in this country, are to be imputed to a deficiency in our own powers of observation; the old adage that it is possible to *look* at an object without *seeing* it, which is not the less true for being trite, being, we apprehend, often verified in the study of the symptoms of disease.

The result of our own experience leads us to the conclusion that there are extreme cases in cerebral affections which can never be mistaken one for another; that there are cases not so well marked, in which the attainment of an accurate diagnosis is attended with greater difficulty; that there are also mixed cases, in which one form of disease, which may have existed separately for a time, gives rise to another, or in which a disease, at first local, becomes general. All these circumstances must necessarily tend to complicate the diagnosis. We should reflect, however, that the study of the pathology of the brain is only in its commencement; that the surest method of acquiring greater power of discrimination is to avail ourselves cautiously of the information and experience of those who have already been labouring in the field, and to bring to the further investigation of this intricate subject a spirit of careful observation and strict induction. We may thus reasonably hope to be enabled in time to rectify their errors, extend the sphere of our knowledge, and establish this important branch of pathology on a more practical foundation. The utmost that can be expected from precise rules of diagnosis, in any class of diseases, is that they should guide us accurately in the great majority of cases; and although it may occasionally happen that they do not accomplish this, they are not on that account to be laid aside as of no value. There is indeed no class of diseases in which the symptoms may not at times prove deceitful; we thus have latent affections of the lungs and alimentary canal without any or with only very slight symptoms; and very decided symptoms of inflammatory or other diseases of these organs without any or at least with only very insignificant disease.

When either the arachnoid or pia mater, which closely invest the brain, are extensively inflamed, the functions of this organ become inevitably disturbed by sympathetic irritation, without its parenchyma necessarily partaking of the inflammation; or if the inflammation extends to the parenchyma, it is mostly confined to the superficial layer of cortical substance. This is exactly the manner in which the functions of the lungs or intestines are disturbed in pleurisy or peritonitis. Hence in arachnitis or meningitis, besides headach and intense fever, we have an increase of the general sensibility, preternatural acuteness of the external senses, violent delirium and convulsions, and, finally, collapse, coma, and death. Extensive and acute inflammation of the hemisphere of the brain will be characterized by a nearly similar train of symptoms. In the great majority of cases the two diseases give rise to each other, and are thus combined; it is then extremely difficult, if not impossible, to discriminate between them. There are, however, other forms of cerebral inflammation more circumscribed in their seat, and chronic in their progress, respecting the diagnosis of which it cannot, we think, be any longer asserted that the practitioner is altogether left in doubt.

We shall now proceed to consider inflammation of the encephalon under two divisions, viz. 1. inflammation of the membranes of the brain (meningitis): 2. inflammation of the substance of the brain (cerebritis).

I. INFLAMMATION OF THE MEMBRANES OF THE BRAIN (MENINGITIS).

When we look into systematic works on medicine, we are at once struck with the confusion which exists in the nomenclature of cerebral diseases. Thus the term phrenitis, which has been so long and so generally known that it has passed into popular use, was employed by some of the earlier physicians to designate that delirium which so frequently arises in the course or towards the termination of different diseases; whilst amongst the moderns it is applied to inflammation of the brain or of its membranes. The group of symptoms which Frank names encephalitis, is called *phrenis* by Vogel, *meningitis* by Herpin, *cephalitis* by Linnæus, *arachnitis*, or more properly, *arachnoïditis* by Martinet: and in different essays and detached publications by various authors, cases strictly analogous are collected together under the denomination hydrocephalus, hydrocephalic fever, or hydrencephalus. All this has arisen from a difference of opinion as to the seat of the disease, one person considering it as located in the cerebral substance; a second in the investing membranes, viz. the arachnoid membrane, the pia mater, or in both; whilst a third is altogether taken up with the consideration of the effused fluid and of the means of removing it; not knowing perhaps that it is a mere consequence or result of inflammatory action, and not at all an element or a constituent of the original disease. Cullen was decidedly of opinion that we could not, by any reference to the symptoms during life, or the appearances presented after death, assign exactly the seat of the different acute affections within the head; and therefore he included, under the term phrenitis, the inflammations of the different structures contained in the cranium, no matter whether seated in the substance of the organ or in its investments. Mason Good gives what may be considered a qualified assent to this view of the subject. He observes that "the disease may commence in the membranes or in the substance of the brain; and if it were to confine itself strictly to the part first affected, instead of spreading from one to the other, there would perhaps be no great difficulty in determining from the symptoms before us its actual seat; for whilst membranous inflammation is accompanied by acute and rousing pain, great heat, and a pulse permanently and considerably quickened, parenchymatous inflammation is distinguished by a heavy and often stupifying pain, slight increase of heat, pulse irregularly quickened, or sometimes, on the contrary, below the natural standard." As each of these conditions is occasionally presented to us in different cases of cephalitis, we may, says the same writer, infer that in the one instance the disease is seated in the membranes, (inflammatio meningica—phrensy—brain fever,) whilst in the other it is situated in the cerebral substance itself, (inflammatio profunda — acute dropsy of the head.)

[Notwithstanding the assertion of some, that meningitis of the different parts of the encephalon may be diagnosticated by certain functional phenomena, it is but too true, that it is almost impossible to pronounce positively, during life, on this matter; and such is the view embraced by the best pathologists. Happily, it is not a matter of moment, therapeutically; meningitis, no matter where situate, demanding precisely the same treatment.]

Nothing has contributed more to the diffusion of error in medicine than the disposition so constantly manifested to consider symptoms as if they were diseases, and diseases—entities, endowed with individuality or a uniform mode of existence. It also but too frequently happens that effects are taken for causes, and, under the influence of a hasty disposition to generalize, conclusions are drawn from partial observations, confined perhaps to a few detached instances. The opinions entertained, and the doctrines taught with regard to inflammation, generally, as a morbid condition, furnish a full illustration of these errors. Are there not many who think and act as if the effusion in hydrocephalus were the essence of the disease, and not a result or effect of inflammatory action? It is with many a fundamental axiom that inflammation softens all textures; hence "ramollissement" or softening comes to constitute the anatomical character of the substance of the brain when inflamed. In point of fact, softening is only a single step or stage in the progress of change, the first departure from the healthy condition being a turgid and tense state of the part affected, which subsequently becomes softened; but instead of passing on to suppuration, in some instances the process of disorganization is arrested, and then the part becomes indurated. Pinel was so fully impressed with these views that instead of following the usual routine of commencing with a definition of inflammation, he considered under so many distinct heads the inflammations of the different primary textures of which the body is composed, indicating the anatomical characters and the peculiar symptoms of each. The arachnoid membrane, for instance, belonging as it does to the class of serous tissues, resembles them in its lesions when diseased, as it does in its character and properties in the healthy condition. Like all the individuals of its class it becomes, when the subject of different degrees and modes of irritation, the seat of serous and purulent effusions, as well as of exudations of coagulable lymph: and as acute inflammation of the pericardium, the pleura, or the peritoneum, are considered as distinguishable by a special train of symptoms, it would be natural to infer that the like lesion of the arachnoid must be attended by its appropriate characteristics.

These general views, which are confessedly applicable to inflammation in other parts of the system, would have induced the learned author of the "Nosographie Philosophique," when treating of the cerebral inflammations, to divide them into separate groups, according as they are seated in the membranes or in the substance of the organ. But he was too discriminating an observer to be biassed by *à priori* views, or led away by the spirit of the system: he admits, that in order to keep up the unity of his plan, it would be necessary to describe separately cerebritis and meningitis, and to cite cases in which the existence of each could be distinguished by a special train of symptoms. This he found to be impracticable, and consequently felt himself obliged to include under one head, *encephalitis*, the general history and the complex and varying symptoms of inflammation, whether seated in the membranes or in the substance of the brain. The majority of our practical men subscribe to the correctness of these views; for they learn by experience that it is much easier to indicate a diagnosis in a nosological table than to support it at the bed-side of a patient.

An examination of the structure of the brain, and of the peculiarities of the circulation in it and upon it, would also lead to the inference, that if the meninges be the seat of inflammation, the contiguous cerebral substance must participate in some degree in the irritative influence. In other organs the vessels, after entering them by trunks and branches of various sizes, branch out and ramify in their interior until they become capillary in their spongy and areolar tissue. But in the brain a different arrangement takes place: the vessels, after entering at the base of the skull, communicate freely with one another, and then branch out upon the surface of the brain, ramifying in an extended web of cellular tissue [pia mater]; in this way they become reduced to so great a degree of tenuity before they enter the substance of the organ, that it may be said to be surrounded by a vascular atmosphere from which its supplies are derived. Hence it is, that as the meninges and the contiguous cerebral substance are supplied from the same source, each will more or less become affected by any inflammatory action set up in the other. [*Meningo-cephalitis.*] M. Bayle, in his thesis, gives six cases of what he considers chronic arachnitis, as in all of them the arachnoid membrane was thickened, opaque, and resisting, and there was found some serous effusion; but in five of these cases portions of the cerebral substance were adherent to the membranes, and so much softened as to be brought away with the latter when an effort was made to detach them: in five of them also the pia mater was injected, thickened, and infiltrated with serous fluid. MM. Martinet and Parent, in their elaborate monograph on arachnitis, give the results of their examination of one hundred and sixteen cases, published with the expressed design of establishing the diagnosis and pathology of arachnitis. But though these cases are classed as inflammations of a serous membrane, we find that in a considerable number of them the inflammation had extended to the cerebral substance, the vessels of the pia mater being at the same time injected, and its substance thickened and covered with a serous or sero-purulent effusion; so that, judging from the post-mortem appearances, they were in fact mixed cases; and in strictness we must refer the symptoms or physiological indications presented during life, to the lesions of the cerebral substance rather than to that of the meninges.

The brain confessedly presides over all the phenomena which are attended with consciousness, and over every act which is influenced by the will; it is the organ of intellect, and the centre of sensation and of voluntary motion. Moreover, through the pneumogastric nerve, it influences directly the functions of digestion and respiration, and indirectly (through the respiratory apparatus) that of the circulation. Experiment also demonstrates its intimate connexion with the regulation of animal temperature. Now if we note the symptoms attributed to inflammation of the arachnoid membrane, or look over the catalogue of them as enumerated by different writers, we shall find that they are but so many lesions or disturbances of one or more of the cerebral functions, and as such they must arise from an affection of the organ itself which holds these functions in dependence, and not of the investing membranes, which cannot exert on these functions any direct control. Thus, when in a summary of the symptoms of arachnitis we find delirium, spasm, and rigidity of the muscles, convulsions, vomiting, stupor, coma, contraction or dilatation of the pupils, with strabismus, we must refer them to an alteration in the function or structure of some part of the cerebro-spinal mass, and not of its investments merely. The arachnoid and pia mater are so simple in their structure and function that we can scarcely assign to inflammatory action when set up in them any other indication except pain or headach.

Dr. Abercrombie expressly gives it as his opinion, "that our knowledge is not sufficiently matured to enable us to say *with confidence* what symptoms indicate inflammation of the substance of the brain, as distinguished from that of its membranes." The difficulty of establishing this point of diagnosis has been felt by all those who have treated of the subject. There are circumstances, however, in which we can indicate with sufficient precision the symptoms of cerebritis, as distinguished from any that can in strictness be referred to meningitis; for instance, when the inflammation is isolated, and does not reach the membranes, as where it is seated in the thalamus or corpus striatum. If in such a case the attack does not proceed with unusual violence or rapidity, the pathognomonic symptoms can be traced readily enough, and no attentive observer would mistake the disease for arachnitis. But if the inflammation occurs at the circumference of the organ, where the membranes and the cerebral substance are in contact, and both are supplied by the same vessels, then, though the inflammatory action may at the outset be seated in the meninges, it will speedily extend more or less to the cerebral substance, and, by complicating the lesion, will confuse the diagnosis. We have examined many cases which, on a superficial inspection or hasty examination, would be set down as cases of acute meningitis; but by carefully elevating the membranes, we could distinctly observe vessels, enlarged and distended, passing into the cerebral substance; and on examining the latter texture attentively, we could also recognise an increase of its vascularity, and occasionally some degree of change in its colour and consistence. In the great majority of superficial inflammations there is a mixed lesion, and all that discrepancy which their progress and symptoms present is explicable not merely by the extent and degree of the inflammation, or by peculiar idiosyncrasy, but by the fact that in some of them the inflammatory action is for the most part expended on the membranes, the brain receiving but slightly the irritative influence; that in others the reverse obtains; whilst in a third group it seems as if concentrated upon the vessels of the pia mater, the arachnoid on the one hand and the brain on the other being but slightly affected. By viewing the subject in this way, (and we are induced to do so from an attentive consideration of it, as well as from numerous post-mortem examinations,) we shall clearly perceive that the diagnosis of the membranous and parenchymatous inflammation in the encephalon has been considered obscure because in very many cases they occur simultaneously. From this mode of considering the subject, it will be obvious that in a practical point of view it is of much more importance to be able to determine what may be considered a previous question, namely, what are the symptoms which indicate inflammation within the encephalon, than nicely to mark its exact location.

Cerebral irritations are divisible into two great classes, symptomatic and idiopathic; the former being by far the more numerous. Broussais goes so far as to say that "the brain is of all organs the one which is the least liable to inflammation, inasmuch as it is seldom if ever affected directly, being almost always acted on through its sympathetic connexions with other viscera." Symptomatic irritation is for the most part connected with and dependent on a morbid condition of the chylopoietic viscera. We frequently observe that for weeks previously to the occurrence of pain or any disturbance in the head, the digestive functions have been impaired, the bowels confined or irregular, and the stools unnatural. In many of these cases, when the headach, retching, irregular fever, and even coma, have set in, speedy and permanent relief has followed the use of purgatives, and the other means usually resorted to for correcting disordered functions. An irritative influence is in such cases propagated from the digestive organs to the brain by reason of the close sympathetic connexion which subsists between them in health and in disease; and that irritation, if kept up for a while, will pass into positive inflammation, marked by its usual consequences. The irritation of worms and of teething may also induce similar results, more particularly in those constitutionally predisposed. We frequently observe these cerebral affections to spring up during the course of other diseases, of which they may be considered as complications; namely, continued fever, scarlatina, measles, hooping-cough; and they not unfrequently follow accidents or injuries. Hence, says Dr. Abercrombie, it becomes necessary to keep in view those symptoms which set in in the course of these diseases, or follow such accidents, and indicate the existence of a dangerous affection of the head. Referring these to their respective seats, they are as follows:—*In the head*—headach, with throbbing and giddiness, tinnitus, sense of weight and fulness, stupor, and propensity to sleep. In many obscure and insidious cases a constant feeling of giddiness is the only remarkable symptom. *In the eye*—impatience of light, unusual contraction or dilatation of the pupil, double vision, blindness, distortion of the eyes outwards, paralysis of the lids, causing the shut eye, or the gaping eye. *In the ear*—unusual acuteness of hearing, great noise in the ears, transient deafness. *In the speech*—indistinct or difficult articulation, unusual quickness or unusual slowness of speech. *In the pulse*—slowness, remarkable variations in its frequency. *In the mind*—transient fits of incoherence, confusion of thought, forgetfulness, high delirium. *In the muscles*—convulsion or partial paralysis. Whilst examining complex cases of this sort, attention should be directed, not merely to ascertain the existence of a particular symptom, but rather to determine whether there is a correspondence and harmony between the symptoms;—thus "the peculiar oppression which accompanies a high degree of fever is not considered dangerous, or perhaps unfavourable; but the same degree of oppression without fever, or with a very slight fever, would indicate a head-affection of a dangerous character." This remark is applicable also to headach and delirium.

Acute Meningitis.—Under this term we shall include all those cases in which the inflammatory action has its principal seat in the membranes, but in which it is a legitimate matter of inference that an irritative influence is propagated to the contiguous cerebral substance.

This affection presents a train of symptoms which varies in different ages and in different temperaments. Its most marked and ordinary character at its outset is an increased sensibility to all sorts of impressions, the ordinary external influences producing inordinate effects. Thus a child is restless and sleepless, seldom even dozing, or if he does doze, from time to time starting and waking up; he attends to every sound, the eyes are suffused, the retina is so sensitive to light that he winks or turns away if his face is directed to a window or to a candle; the pupil is generally contracted, but not invariably so. The head is often moved about, or from side to side, so are the limbs; the temper is peevish, and nothing seems to soothe this irritable condition but motion up and down the room in the arms of the nurse or attendant. The state of the bowels varies much in different instances; they may be confined or relaxed, but the stools do not present any unnatural appearance. There is a minor degree of this state which is marked by increased animation and liveliness, which with ordinary observers may pass for an increase of health and vigour, though an attentive observer will readily perceive that the countenance wants that disengaged air which exists in health; and on making a closer examination he will find that the eyes frequently close and wink, and the countenance assumes an expression as of frowning: the hand, too, is frequently raised towards the head, and the fingers are fixedly closed. We occasionally observe in children a state the very opposite of this—a state characterised by a want of animation, accompanied by plaintive moaning at times, and an indifference to surrounding objects. Though the child does not sleep, yet his state is not that of waking; and if roused, he betrays fretfulness and peevishness. These may be considered as so many indications of an incipient irritation, which in some constitutions may arise independently of any assignable agency, but which in many cases is referable to an irritation propagated to the brain from the peripheral extremities of the nerves during dentition, or by worms in the alimentary canal, or by vitiated secretions, or a torpid liver. The symptoms here indicated are by some persons denominated *fever*, some epithet being usually added for the purpose of indicating its source or its nature; hence the terms gastric, irritative, and hydrocephalic fever. The most expressive term that can be employed is that devised by Dr. Nicholl, "sensitive erethism." It is distinct from inflammation of the brain, of which it is frequently the precursor; and according to individual peculiarities or other modifying circumstances, it may end in cerebritis, meningitis, or that modification of the latter called hydrocephalus: and this termination is but too often unexpected by the practitioner, whose attention has perhaps been directed to secondary indications and minor effects, whilst the erethismal state of the brain has crept on unheeded. The condition here indicated cannot be supposed to exist unaccompanied by an increased flow of blood through the cerebral vessels, or in other words, an increase in their degree of tension; and as the tension may vary from a slight degree of fulness to the greatest of which the vessels are susceptible, such a state of local determination of blood will soon end in inflammation if not subdued by proper means. The actual inflammatory attack is generally ushered in by headach more or less violent, (the pain being referred to the temples, the vertex or forehead, sometimes to the occiput and base of the skull,) by intolerance of light: heavy and suffused eye, with quick pulse, are also attendants; so, in many instances, is vomiting. In adults, particularly those who have suffered much from mental disquiet, spasmodic twitchings are sometimes perceived, not unlike those which arise from slight electric shocks. In children and very young persons it frequently commences with a sudden and long-continued convulsion without any previous warning. After a while the convulsive movements cease, a remission takes place, and the patient appears free from complaint for one or more days, when a second attack occurs, which may terminate in coma and death. Some instances have been cited in which no remission occurred, insensibility supervening on the convulsion, and death in thirty-six or forty-eight hours. Martinet indicates three stages of the disease, each accompanied by a distinct group of symptoms. The first comprises the period of cerebral excitement and increased sensibility above noticed; the second is the stage of re-action, or more properly that in which the cerebral irritation is propagated to the muscular system, and other systems in immediate dependence on the brain; hence it is characterised by restlessness and convulsions, delirium, oscillations or commencing dilatations of the pupils: its duration varies from two or three days to a week, or perhaps two weeks. It is not undeserving of notice, that when the arachnitis is seated on the convex surface of the cerebral hemispheres, delirium sets in very early, and becomes the prominent and characteristic symptom; whilst if it occurs at the under surface and base of the brain, coma is the more usual attendant, and sets in early. The third stage is that of collapse; being marked by loss of sense and motion, by paralysis, local or general, and coma; its duration varies from a few hours to three or four days. A considerable number of cases do in fact exhibit these regular steps and gradations of change during their progress; but we frequently observe the state of collapse and of excitement to co-exist; each of course being partial in its extent. Thus one arm may lie motionless by the side, whilst the other is convulsively agitated; and the muscles of the eye-lids may be paralysed, whilst those about the mouth are convulsed. Again, the first stage of the disease is not in all cases ushered in either by pain or convulsions, by vomiting or fever. A state the very opposite to this sometimes presents itself. Thus Cruveilhier details the case of an elderly medical man, who, after some fatiguing employment, suddenly became oblivious, looked stupid, could not answer questions, and seemed apoplectic: he was treated accordingly, but without relief; he still remained comatose, passed urine involuntarily, but retained the power of moving his limbs, though the left side seemed weakened. After death, serous effusion was found beneath the arachnoid membrane, extensively diffused over the brain and cerebellum, mixed with albuminous flocculi or flakes of false membrane. This would be considered as a case of serous apoplexy were it not for the effusion of lymph and false membrane. Another case was considered a feigned disease, so few indications of ill health, much less of cerebral inflammation, did it present. It was that of a youth at school, who was frequently accused of feigning illness. His countenance was natural, pulse not at all excited, nor did he complain of pain. The medical attendant ordered him to get out of bed and dress himself. This he submitted to very reluctantly; he went towards the fire-place, tottering as he walked, and sat down resting his head against the chimney-piece. So convinced were all present that he but feigned illness, that he was chastised. He died soon after, when the reality of his illness was ascertained by examination; a considerable degree of effusion of serum and coagulable lymph being found beneath the arachnoid membrane. This form of disease Cruveilhier calls "*meningite sous-arachnoïdienne comateuse;*" and as he has met with several instances of it, he is disposed to come to a conclusion the very opposite to that which other pathologists have adopted, inasmuch as when the meninges over the convexity of the hemispheres is inflamed, it is, according to his experience, characterised by stupor gradually increasing to coma, whilst headach, with increase of sensibility, delirium and convulsions, are strangers to it.

[Of late years, the formidable disease of the encephalon, that occurs so frequently in young children, and is generally called *hydrocephalus acutus*, has been regarded as *tubercular meningitis;* or, in other words, as a deposition of tubercular granulations on the under surface of the cerebral layer of the arachnoid, which is essentially strumous in its character: and many cases are, doubtless, of this nature. (See HYDROCEPHALUS.)]

Morbid Anatomy.—After having been the subject of inflammation, the membranes present various changes dependent either on the duration and intensity of the attack, or on the frequency of its recurrence; but all of them are referable to the following heads, namely, simple redness of the arachnoid; thickening and opacity, with increased firmness; serous effusion beneath or upon it, or into the ventricles; puriform, or sero-purulent exudations; false membranes; increased vascularity and thickening of the pia mater. The redness of the arachnoid varies in extent and degree, and is usually confined to a few points on the convexity of one or both hemispheres, or at the base of the brain. It requires much care to distinguish this state of the membrane from one that closely resembles it, and in which the pia mater is minutely injected, and at the same time adherent to the arachnoid. To determine whether the redness exists in the arachnoid or only in the vessels of the pia mater, a part of it should be cautiously raised from the surface of the convolutions, and gently scraped with a scalpel, or exposed for a few minutes to a slight current of water; if the membrane is really inflamed, the colour will be found persisting, as if it were dyed into it; if the membrane is not inflamed, its natural transparency will be restored. The alteration most commonly observed in the arachnoid is that it becomes opaque and whitish. In proportion as its transparency is diminished, its density and tenacity increase; so that it is easy to detach it from the surface of the brain. These changes are seldom, if ever, general; they are usually confined to some parts on the upper surface of the hemispheres, or at the base. In most cases there is no appreciable increase of thickness, the membrane being merely a little opaque, and of a milky hue. This condition of the arachnoid is almost invariably accompanied by an effusion of serous fluid, either upon its free surface, beneath it, or into the cavity of the ventricles. The effusion varies in quantity, being sometimes not more than a few drachms, and in other instances amounting to several ounces. It is usually limpid, particularly when contained in the ventricles; but occasionally opaque or milky, and mixed with albuminous flocculi or shreds of lymph if an exudation of false membrane exist at the same time. When the effusion is beneath the membrane, this is elevated along the sulci which separate the convolutions, and presents a gelatinous appearance, as if it had suffered a change of structure; but if an incision is made along the surface, the fluid can be made to exude, and then the membrane subsides to its original position, and exhibits no other change except that of being a little opaque and thickened.

Dr. Abercrombie notices a modification of this disease, remarkable from its rapidity and from simulating hysteria, or even mania; although on examination it presents merely a highly vascular and injected state of the pia mater, complicated in some instances with slight subserous effusion. It commences with depression of spirits, to which cheerfulness soon succeeds, but finally passes on to delirium. The patient's manner is hurried; he talks rapidly, wandering from one subject to another. Obstinate watchfulness exists throughout; the pulse is small and rapid; the countenance pale and expressive of exhaustion. The treatment is founded on these circumstances. Stimulants cautiously given afford relief, while depletion aggravates the evil, or produces but a temporary alleviation.

Chronic Meningitis.—Meningitis is in many instances so slow in its progress as to assume the chronic form. The disease is then characterised by a different train of symptoms. According to Bayle, delirium and progressive paralysis are the constant attendants of chronic meningitis. The delirium is at first partial; it is a monomania with weakness of intellect; but, after a time, it passes on to maniacal excitement, and finally subsides into confirmed idiotcy. The paralysis in those cases does not exhibit a total privation of sensation and motion in any particular part of the body; it is at first slight, but gradually increases, and extends to the whole muscular system, rendering the gait feeble and vacillating, and ultimately destroying the power of motion. It is remarkable that the diminution of sensation is not proportioned to that of motion. Spasmodic movements, with contraction and rigidity of the limbs, sooner or later set in; and, finally, epileptic attacks, which terminate in fatal apoplexy.

Besides the injection and thickening of the membranes, and the serous and albuminous effusions presented by the more rapid cases, the free surface of the arachnoid is found studded with minute conical granulations, or flocculi, so as to lose its smooth and polished appearance. Contiguous parts of the membrane are also occasionally found connected by bands of false membrane; this most frequently occurs at some point of the inner flat surface of the hemisphere, where it is in contact with the falx major. The investing and reflected parts of the membrane are also found closely adherent along the angle formed by the inner and upper sides of the hemisphere, where the superficial veins enter the longitudinal sinus. In this situation the surface of the arachnoid is found rough, and studded with small rounded or irregular masses of a greyish white colour, which are sometimes called glandulæ Pacchioni. These productions do not exist in early infancy, or in the healthy condition of the organ; they appear to be an albuminous exudation, the result of chronic inflammation. In many cases the membranes are adherent to the subjacent cerebral substance, which is found altered both in colour and consistence. [Of 151 cases, observed at Charenton, 65, according to M. Andral, (*Pathologie Interne*,) lasted from a month to a year; 81 from one to six years; and 5 from six to twelve.]

Causes.—Meningitis is a frequent consequence of injuries of the head, of fractures, concussion, or even wounds, of the scalp. It not unfrequently happens that a wound of the head heals rapidly, and that the patient returns to his usual occupations, thinking himself quite well; but after ten or fourteen days he begins to feel pain in the situation of the wound, which gradually increases in intensity; and in a very short time all the symptoms of cerebral inflammation become manifest. A child may suffer serious injury from a fall, and as all mention of the accident is suppressed by his immediate attendant, it escapes the notice of others, and no ill effects follow perhaps for a week or two: the child then, however, loses appetite, becomes restless and irritable; febrile excitement, delirium, and convulsions succeed, and too often are the precursors of a fatal termination. In such cases, the real cause of the disease not being suspected, it is generally attributed to the irritation arising from dentition or worms; but examination after death shows that it is not merely a sympathetic disturbance, there being abundant evidence of active meningitis.

In the list of causes should also be included depressing passions; sudden fright, or unexpected disappointment; violent emotions; immoderate indulgence of any sort, particularly in the use of spirituous liquors; the suppression of cutaneous eruptions, and habitual evacuations or discharges; insolation (*coup de soleil*) in warm climates; deposition of bone in the dura mater; tubercle developed in the cerebral substance, and extending to the circumference of the hemisphere, so as to become a mechanical irritant to the membranes.

Such are the exciting causes of meningitis; but there are predisposing circumstances which confessedly render some persons more liable to it than others. One class of persons consists of those who possess what is termed the apoplectic constitution, indicated by a large head, short neck, and sanguineous temperament; the other class exhibits evidences of the lymphatic temperament, together with considerable cerebral development, indicated by precocious talent. Such persons in early life are very liable to attacks of meningitis, which terminate in serous effusion. Sex also seems to be a predisposing cause, or rather the peculiar pursuits and habits of the sexes; for males are more liable than females, according to Martinet, in the proportion of three to one. All ages are liable to this affection, but not equally so: of one hundred and sixteen cases recorded by the author just cited, twenty-nine were under fifteen years, forty-four from fifteen to thirty, thirty-eight from thirty to sixty, and five from sixty to eighty. These results, it should be remembered, are taken from hospital practice, in which the great majority of patients are adults. In private practice the proportion of cases under puberty is much greater than that here stated. The ordinary duration of acute meningitis is from seven to ten days, but death may occur on the third or fourth; few cases are prolonged beyond the twenty-fifth or thirtieth.

[Chronic meningitis has been rarely seen in infancy. It is also uncommon between the ages of 20 and 25; but is more common between 25 and 30; and attains the maximum of frequency at from 30 to 50. As in insanity, a predisposition to it would seem to be laid in organization, for it appears in some families more than in others, and more commonly in the children of parents who have suffered by it. It has been induced by powerful emotions, and it is affirmed by the abuse of alcoholic liquors. (The writer's *Practice of Medicine*, 2d edit. p. 180: Philad. 1844.)]

The treatment of meningitis will be included in the subsequent article, on inflammation of the substance of the brain.

J. Quain.

II. Inflammation of the substance of the brain (Cerebritis).

We find very little information on the subject of inflammation of the substance of the brain, as a distinct and separate disease, in the early records of medicine. It has scarcely obtained a separate place in any of the nosological arrangements; every variety of inflammation, both of the brain and its membranes, being generally classed under the head of *phrenitis*. Bonetus and Morgagni are among the first writers who make any mention of the morbid alterations of the brain arising from inflammation; but they give no very distinct history of the symptoms, being satisfied, in general, with naming the diseases: many of their observations, indeed, are evidently taken from casual examination of bodies in the dissecting-room, and therefore afford very little satisfactory information. Sauvages sets down loss of sleep, headach, subsultus tendinum, and convulsions, as symptoms of arachnitis, and low delirium as that of encephalitis. Cullen includes all the inflammatory affections of the brain and its membranes under the head of phrenitis, stating his inability to distinguish them from each other; and the same course is followed by Frank. Pinel, in his Nosographic Philosophique, endeavours to draw a line of demarcation between inflammation of the membranes and that of the brain itself, but this attempt is altogether hypothetical: he, however, states that after ataxic fevers he has found injection, inflammation, and suppuration in the brain and its membranes, and therefore considers them as the seat of the disease. Several other French writers have alluded to inflammation of the substance of the brain as a concomitant of ataxic fevers. Dr. Mason Good, in his Study of Medicine, ranges inflammation of the brain under one species, which he terms empresma cephalitis; and he makes out two varieties, one superficial inflammation, called meningea, phrensy or brain fever, and the other profunda, affecting the substance of the brain and lining membranes of the ventricles, to which he refers hydrocephalus acutus; but he merely follows other nosologists in his description of symptoms and causes. The first distinct account given of that peculiar alteration of the brain called *softening*, and of its characteristic symptoms, was by M. Recamier, physician to the Hôtel Dieu, in Paris, who considered it as one of the terminations of nervous fevers. Several of his pupils, and more especially Lallemand, Rostan, Parent, and Martinet, have since pursued the investigation of this interesting branch of pathology with considerable success, and have published valuable works on cerebral diseases. Nearly about the same period the attention of the profession in Great Britain was directed to this subject by Dr. Abercrombie, whose pathological researches on diseases of the brain are held in high estimation on the continent, as well as in his own country. Some separate cases of inflammation and suppuration of the brain are to be found in Dr. Baillie's excellent manual of Morbid Anatomy. He refers to Dr. John Hunter's account of softening of the brain in the Gulstonian Lectures, read before the College of Physicians in 1796, describing two forms of softening; that which occurs in old age, and that which is combined with apoplectic effusion. A valuable addition has been lately made to our medical literature in this branch of pathology by the medical reports of Dr. Bright, whose splendid plates of the diseased structure of the brain are admirably illustrated by a history of well-selected cases. It will be seen by this brief sketch of the information afforded in medical writings on inflammatory affections of the brain, that it is only within our own times that our knowledge of these diseases has begun to assume a practical and systematic character.

Inflammation of the substance of the brain may be divided into *general* and *partial*, *acute* and *chronic*. The general inflammation is always acute. The partial inflammation may be acute or chronic. Inflammation of the brain sometimes commences suddenly; this is not, however, the most ordinary case. It is generally preceded by a variety of premonitory symptoms; and as the disease, when once fully developed, is very formidable, it is of the highest importance that the practitioner should be well acquainted with these symptoms.

The most usual *premonitory* symptoms are, a general uneasiness and restlessness, with a tendency to congestion in the head; a sense of weight and fulness; occasional attacks of pain in the head, or of temporary apoplexy or epilepsy; flushing of the face and increased heat of the head; drowsiness and vertigo; preternatural acuteness of the external senses; intolerance of light and optical illusions; contraction of the pupils, strabismus, or imperfection of sight; tinnitus aurium, or various other noises in the ear; confusion of thought; failure of the memory; mental excitement or depression, or some striking alteration in the habitual character and pursuits of the individual. In some cases there is little appearance of indisposition throughout the day, but the symptoms are aggravated at night: the sleep is uneasy or disturbed by alarming dreams, and in children there is often grinding of the teeth. Pains in the limbs and frequent cramps, general lassitude and muscular debility, are often felt, alternating with fits of shivering and feverishness; the digestive functions are disordered; there is in general loss of appetite; often obstinate vomiting: the bowels are either irritable or torpid, the secretions being always unhealthy.

The above symptoms precede either general or partial inflammation of the brain. Those which follow indicate more especially the invasion of partial and chronic inflammation. A long-continued, fixed, and deep-seated pain in one part of the head; pain, numbness, weakness, a sensation of creeping and tingling in one extremity or in one half the body; or confined to one portion of the extremity: there may be numbness and loss of power in one finger only, or in one set of muscles. Sometimes the speech is affected so as to produce a degree of hesitation, stuttering, or indistinctness of pronunciation. Drowsiness, languor, depression of spirits, are observed also more particularly in the chronic form of cerebritis. Some of these premonitory symptoms may have been present for weeks, for months, or even for a year, or for a longer period. The practitioner cannot be too deeply impressed with the importance of the discovery and due appreciation of the foregoing train of symptoms: many of them may be overlooked by the patient, unless his attention be called to them; he attributes his ailments to nervousness, debility, rheumatism, gout, and any but the real cause. He is allowed, perhaps, to live well; his stomach is strengthened and his nerves are soothed; whilst the disease in the brain, which will certainly end in death, is suffered to pursue its course.

I. **General Cerebritis.**—General cerebritis is always acute. Its symptoms have been divided into two periods: 1. the period of irritation or excitement; 2. the period of collapse.

The symptoms which characterize the period of excitement are, intense pain extending over the greater part of the head; great excitement of the cerebral functions; violent delirium; preternatural acuteness of both the external and internal senses; intolerance of light; brightness, redness, wildness, or protrusion of the eyes; contraction of the pupils; tinnitus aurium; flushing of the face; throbbing of the temporal arteries; paroxysms of general convulsion; rigidity of some of the muscles on one or both sides of the body in the interval of the paroxysms. There are also severe shooting pains in the extremities, greatly increased by extending them; twitchings of the muscles of the face; rolling of the eyes; quick, suspirious, and irregular breathing; rapid, full, and hard pulse; subsultus tendinum; red and dry tongue, either tremulous when protruded, or in violent motion, pushing out the cheek, or forcibly thrust out of the mouth; great thirst; occasionally severe vomiting, especially in children; scanty and high-coloured urine. The paroxysms of convulsion are always attended with an exacerbation of the symptoms. The respiration is hurried, and the pulse rises suddenly forty or fifty beats in a minute. When the convulsions subside, the pulse and respiration become comparatively slow and feeble.

The symptoms just enumerated may last from twelve to forty-eight hours, or more, when they are succeeded by others of an opposite character, which constitute the second period, or that of collapse. The headach is now no longer complained of; the delirium gradually passes into stupor and coma; the preternatural acuteness of the senses is succeeded by obtuseness and insensibility; the convulsions subside into general muscular relaxation, and more or less complete paralysis succeeds. The pupils become dilated and motionless; the eyes sunk, pale, and dim; there is sometimes strabismus, or deafness; the pulse is rapid, small, unequal, or intermittent; there are frequent rigors, the skin afterwards feeling cold and covered with a clammy sweat; the face is pale, sunk, and cadaverous; the respiration is slow, or irregular and stertorous. When the patient lies senseless on his back, and swallows with difficulty, the fatal issue is not far distant. There may be several alternate paroxysms of excitement and collapse, until the patient finally sinks into a state of coma, which soon ends in death.

A great resemblance is apparent between the preceding delineation of general cerebritis and that of arachnitis. A more strongly marked and permanent degree of rigidity in the muscles on one side of the body is, however, believed more particularly to indicate cerebritis. The disease may have been preceded by some of the premonitory symptoms, and have set in with headach and delirium, terminating in coma; or the invasion may have been sudden, and attended by a violent paroxysm of convulsions. In the former case, it is probable the inflammation had its origin and principal seat in the brain; in the latter, that it was confined to the membranes. The diagnosis between the two cases is, however, extremely difficult; the one generally giving rise to or terminating in the other.

The symptoms are of course variously modified, according to the extent and intensity of the inflammation, which may occupy one half of the brain and extend in depth, or may be spread over the surface, or affect several isolated portions in both hemispheres.

General cerebritis in most instances proves speedily fatal; the inflammation of a large portion of the brain being incompatible with the prolongation of life. In the majority of cases on record, death occurred within a week; in some within twenty-four or even twelve hours, the inflammation scarcely ever going beyond the first stage.

This form of inflammation of the brain may exist in combination with inflammatory affections of other organs, and occasion modifications in their symptoms demanding close attention. The intense pain arising from inflammation in the abdominal and thoracic viscera, when such a combination exists, may not be felt by the patient, although the inflammation is pursuing its course unabated. This has sometimes led to the dangerous mistake of believing a disease removed which was only masked. Hippocrates was acquainted with this source of delusion, for he says that whenever a patient suffers and does not complain, *mens ægrotat*, the mind is diseased. We have seen serious consequences follow this deception in cases of continued fever with head symptoms. In such cases, therefore, the practitioner cannot be too much on his guard; and the very circumstance of the denial of pain, without amendment in other respects, should induce him to ascertain, by manual examination and every other means, the true condition of the principal viscera. Particular attention should be paid to the region of the bladder; as from insensibility, the bladder gets over-distended and partially paralysed; the resistance of the sphincter vesicæ is overcome; the urine dribbles out by drops, and the patient is supposed to suffer from incontinence, whilst he is, in reality, affected with retention of urine. The same insensibility is the cause of the great difficulty sometimes experienced in exciting vomiting in cerebral affections.

II. **Partial Cerebritis.**—Partial inflammation of the substance of the brain may be acute or chronic; the disease assuming a variety of forms according to the severity, extent, and seat of the inflammation. Its invasion is generally slow, and preceded by some of the premonitory symptoms, which are, in fact, the mere signs of that state of local congestion and irritation which immediately precede inflammation. We shall first give a description of the principal forms of the disease, and then take a general view of the symptoms.

1. In partial cerebritis, the individual is attacked with fixed, deep-seated pain in the head, vertigo, dimness of sight, hesitation of speech, sensation of tingling, pain, cramps or weakness in one or other of the extremities; one of the limbs suddenly giving way during exercise, so as to occasion stumbling; or the walk is unsteady, like that of a drunkard. The general health is, at the same time, more or less impaired. These symptoms may have gone on for a certain time without fever or affection of the intellect; so that no serious alarm has been excited till the patient is suddenly seized with an attack of coma and insensibility. He may recover from this in a few minutes or hours, when one arm or leg, or even one half the body is found paralysed. The paralysed limbs are almost always first in a state of permanent rigidity, and more or less bent, in consequence of the flexor muscles having greater power than the extensors. Lancinating pains are also felt in the muscles, and much increased by extension. From all these symptoms the individual may so far recover as to be able to leave his bed, the limbs continuing paralysed; in other cases, some degree of stupor and mental weakness remains, with a peculiar frowning or vacant expression of countenance; the patient still, however, showing some signs of intelligence when roused. Several of the external senses may be affected; the sight of one eye, for instance, may be impaired or destroyed: or there may be dilatation and insensibility of one pupil, and contraction of the other, or strabismus. In like manner, the sense of hearing may be imperfect, or wholly lost. There may be symptoms of low fever, with delirium; but there is seldom any violent re-action. The assemblage of symptoms just described constitutes the *first period* of the disease, or that of cerebral irritation.

After various intervals, a second or even a third attack of coma is experienced, and the patient either dies suddenly or sinks under gradual exhaustion. As the disease advances, a change takes place in the state of the paralysed limbs; the rigidity, gradually subsiding, is succeeded by relaxation, flaccidity, and complete paralysis. This marks the *second period* of the disease, or that of softening and complete disorganization of the portion of brain affected.

2. In many cases the paralysis of the limbs is at first only partial; a certain degree of motion is preserved, but there are convulsive spasms, generally of short duration; and after alternate attacks of this description, the paralysis gradually becomes complete. This order of the symptoms generally corresponds with the progress of the inflammation from the first stage, or that of excitement, to the second, or that of softening and suppuration.

When the inflammation spreads from the brain to the membranes, constituting the combination of partial cerebritis and arachnitis, the side of the body not paralysed is generally affected with paroxysms of convulsion, in which sometimes the paralysed parts themselves participate. These diversities in the affections of voluntary motion will be more particularly considered in the general review of the symptoms.

3. The order in the progress towards complete paralysis just described is sometimes reversed; there being at first sudden and complete resolution of the muscles; and the spasmodic rigidity with convulsions only appearing some time after. It not unfrequently happens that, if the congestion be violent and sudden, and the blood-vessels weak or diseased, extravasation of blood takes place in the brain, either by rupture of a blood-vessel or exudation, before the inflammation has had time to set in. Instead of a gradual loss of voluntary motion, with spasmodic irritation of the muscles, there is then a sudden and complete abolition of muscular power in some regions of the body, and a state of perfect paralysis, in consequence of the sudden destruction of a portion of cerebral substance, and of the pressure exercised by the clot of blood. This difference in the mode of attack forms a good line of distinction between sanguineous apoplexy and cerebritis, in the great majority of cases. After a certain time, however, the clot of blood irritates the surrounding cerebral substance, and excites inflammation: pains, cramps, and convulsions are then experienced in the relaxed and paralysed muscles, so that they sometimes become perfectly rigid: this constitutes the form of disease known as *consecutive cerebritis*. Apoplexy and cerebritis are diseases which frequently have a common origin, viz. cerebral irritation and congestion, and are only modified in their progress by accidental circumstances; though in apoplexy it is too often the custom to consider only the extravasated blood, which is a mere effect, and to overlook the previous morbid condition of the brain which was the cause of the hemorrhage. The invasion of

cerebritis is generally slow, and characterized by premonitory symptoms; the course of the disease is marked by great irregularity, by frequent exacerbations of some of the symptoms, and by deceitful remissions. Apoplexy, on the contrary, takes place more suddenly, and often without any very decided premonitory symptoms; the paralysis is more complete from the beginning, and the progress of the disease less variable. Apoplectic extravasation of blood sometimes takes place in the advanced stages of cerebritis, by the bursting of a vessel in the centre of the softened mass of brain: a sudden attack of coma is generally the consequence. The pre-existence of the symptoms of cerebritis will afford a sufficient distinction of such a case from common apoplexy.

4. Partial cerebritis is sometimes *acute*, and the inflammation passes rapidly through its different stages, as may easily be conceived in an organ so vascular and highly organized as the brain. The patient may in that case sink under the first attack of coma, and the disease will be generally found to occupy a considerable portion of the brain.

Even when the disease is limited to a small extent, it may prove rapidly fatal, in consequence of the portion of the brain it affects; as, for instance, when its seat is in the medulla oblongata, or contiguous to the arachnoid and pia mater. It is proper also to remark that the extent of the injury arising from disease of the brain is very much in proportion to the rapidity of its development: a very slight degree of pressure, if suddenly applied, is capable of creating violent constitutional disturbance; this will account for the disproportion sometimes observed between the severity of the symptoms and the extent of the disease. When it commences by an attack of paralysis, without coma, delirium, or any serious affection of the head, the inflammation is commonly at first slight, and seated near the origin of the spinal cord.

5. There is another form of cerebritis, in which the inflammation is of a more *chronic* character; the disease more slow, obscure, and variable in its progress, and the paralysis of the muscles neither preceded nor attended by symptoms of irritation. The disease may commence with a slow and gradual loss of power, at first limited to a single region of one of the extremities, or to a single set of muscles, and without pain, cramps, or rigidity; the tongue may be affected, or the sight of one eye; or there may be slight distortion of one side of the face: the paralysis gradually creeps on, until it has invaded successively the upper and then the lower extremity, on one and sometimes on both sides of the body. The disease is not attended in its progress with any general re-action, the only appearances of disturbed health, for a length of time, being symptoms of debility and decay, both bodily and mental; until, at the end of several months, or perhaps longer, the patient is suddenly seized with coma and convulsions, or else sinks under gradual exhaustion. There are sometimes, however, deviations from this uniform course, and the progress of the disease, although slow, is marked by occasional affections of the head and symptoms of general irritation. This is the form of disease which has appropriately enough received the appellation of *creeping palsy*. It usually proceeds from a low state of inflammation of the brain. commencing in a small portion, and gradually extending to a larger one; the inflammation generally continues for a considerable time in the first stage; it may prove fatal in that stage, with symptoms of coma and convulsion; or pass on to softening and abscess, with their usual consequences. This is the form of disease which usually attends that variety of white softening called *simple softening*, in which the arteries are frequently found diseased. The disease also sometimes terminates in permanent *induration* of the portion of the brain affected.

A good many cases of partial *induration* of the brain have been related by Morgagni, Baader, Abercrombie, &c. &c.; they were all of a protracted nature, and characterized by a degree of irregularity and intermittence in their symptoms, which closely resembled those of organic disease. The disease in some cases assumed so completely an intermittent form as to mislead with regard to its real character. This tendency to periodicity is of frequent occurrence in all the chronic forms of cerebral inflammation.

There is a variety of chronic cerebritis peculiar to lunatics, who, after being affected for a considerable time with acute mania, have gradually sunk into imbecility and idiotcy. The paralysis is not confined to one region, but extends to the whole muscular system; it is at first slight, and only indicated by a general tremor and debility; a sluggishness and vascillation in all the motions; fatuity, and sometimes low delirium: these symptoms gradually increase; the sensibility becomes obtuse, and the disease generally terminates in paralysis with spasmodic rigidity, or in apoplexy. The appearances after death are—redness, softening, sometimes atrophy, and a granulated appearance of the cortical substance on the whole surface of the hemispheres; chronic inflammation of the membranes, which adhere firmly to the surface of the brain; serous effusions; an indurated state of the medullary substance, sometimes with partial softening.

6. Partial cerebritis is sometimes connected with disease of the *cranial bones*. Desault, Abercrombie, and others, have recorded some interesting cases of a disease of the inner table of these bones, the outer table remaining perfectly sound, so that there was no external indication of the disease. The symptoms were characterized by fixed, intense, and deep-seated pain in the head; a disturbed state of health; violent delirium; drowsiness, double vision, and coma. The disease seems to have been the result of a very slow inflammatory action, lasting in some cases for many years, and gradually destroying the bone by caries. On dissection, the inner table of the bone has been found destroyed; the rough cancellated structure covered with lymph. or adhering to the inflamed and thickened dura mater; the membranes adhering to the brain, which was inflamed and softened. In some cases the bone has been reduced by absorption to a transparent thinness; the dura mater being also partly absorbed, and the brain livid and indurated. In others, after a blow on the head, a small portion of the cranium has been completely absorbed without any ulcerating process, leaving the brain covered

only by the healthy skin. Two instances of this kind are related by Mr. Howship and Mr. Wilmar: in one of them there was hemiplegia; both patients survived, but the deficiency of bone was not supplied. More generally, however, both plates of the bone and the intervening diploë are affected with chronic inflammation, which brings on a variety of morbid changes; such as the formation of bony tumours, or ridges, caries, exfoliations, or excessive thickening of the integuments: these finally lead to inflammation of the brain and its membranes. Saviard mentions the case of a woman in the Hôtel Dieu, in whom, in consequence of an injury of the head from a fall, successive exfoliations of both tables of the cranium took place to such an extent that the pieces, when put together, resembled the skull-cap as it is sawn off in dissection: this process occupied two years, at the end of which she was dismissed in good health, but with the upper part of the brain covered only by integuments.

There is a variety of the disease beginning in the pericranium, which is often accompanied by very urgent symptoms; it is a chronic inflammation of the periosteum, with thickening, induration, and sometimes suffusion of pus. The corresponding portion of dura mater is inflamed and thickened, and the disease extends to the brain; the intervening bone in some cases remains healthy, in others it is also diseased. It is attended with intense, fixed pain, and there is sometimes such exquisite tenderness in the part, that the slightest pressure brings on syncope and convulsions: there may be also various affections of the sight, hearing, speech, and intellect, and various forms of paralysis or convulsions. Relief has generally been afforded by deep incisions down to the bone, and by exciting and keeping up suppuration. It may be necessary in some cases to repeat the incisions. In some instances related by Mr. Crampton, the disease appeared as a circumscribed tumour: in one, the swelling spread considerably, and was accompanied by erysipelas; more generally, however, there is no visible tumefaction.

One of the distinguishing features of these various forms of disease is, their very slow progress, owing to the low state of inflammation of the parts affected; they have been known to last for years, and even during a great part of a patient's life; and an apparently very slight degree of inflammation has in some cases given rise, for a considerable length of time, to the most urgent symptoms. The inflammation has been excited in some instances by an injury so trivial as to escape the patient's attention; though it should be kept in view that it is not always confined to the part which was the seat of the injury, but has sometimes a tendency to spread over the cranium. It may also occur spontaneously, in which case it is occasionally connected with a syphilitic taint, or scrofulous diathesis.

In chronic otitis there is a great tendency in the inflammation to spread from the inner ear to the brain: suppuration of the brain has also, in some cases, made its way out by the ear; and it is generally remarked, that when the suppuration from the ear is checked or suppressed, this is almost immediately followed by symptoms of acute cerebritis; and again, that as soon as the suppuration of the ear is restored, the symptoms of cerebral inflammation disappear. This affords a striking proof of the effects of pressure, and points out the great caution which is required in the treatment of otitis, to prevent the extension of the disease to the brain.

7. We shall conclude this account of the different forms of cerebritis with some general remarks on the progress of the disease. It sometimes pursues its course without intermission, either to a favourable or fatal termination, with only occasional exacerbations of the symptoms. At other times there are well-marked remissions, with an apparent amendment. When cerebritis passes from the first stage of inflammation, or that of excitement, into the second or that of softening, there may be such a remission of the febrile symptoms, although the paralysis remains, as to excite hopes of recovery. This should not, however, deceive the practitioner, as the improvement is often merely delusive, and soon followed by repeated relapses. There are occasional instances of the symptoms assuming a remarkable *periodical* course, and returning at regular intervals. In one case, after a wound in the head, the patient was seized every evening with a paroxysm of delirium, succeeded by stupor; he died in the course of the fifth paroxysm; and on dissection there was found extensive inflammation of the membranes, and suppuration of the brain. In another case, in which the paroxysm set in at the same hour, lasted exactly the same time, and recurred every second day, the symptoms were those of well-marked cerebritis, and there was complete apyrexia during the intermissions; the arachnoid and pia mater were found inflamed, and there was a large undefined abscess in the middle lobe of the right hemisphere. These cases had been mistaken for pernicious intermittent fever, and treated by bark. It is not easy to explain satisfactorily the cause of these regular exacerbations and intermissions; they are probably the effect of some sudden congestion in the brain, aggravating the symptoms. There is a well-known tendency to periodicity in all the affections of the cerebral and nervous system; the formation of pus in every vital part is also known to be attended with occasional rigours and paroxysms of hectic fever. This tendency to intermittence and periodicity is most frequent in chronic cerebritis.

A number of interesting observations on cerebritis in horses have been made by M. Dupuy, professor in the Veterinary College of Alfort, near Paris. The spinal marrow was found more frequently affected than the brain; which is easily accounted for by its being much larger in these animals, in proportion to the brain, than in man; and by its being also much more exposed to suffer from violent muscular exertion. The morbid alterations after inflammation corresponded in every respect with those observed in the human subject: the symptoms attending the disease were —tremor of the extremities, weakness, convulsions, tetanic stiffness of the muscles of the neck, jaws, and more especially of the hind-quarters, which were the first to be affected with paralysis. One remarkable symptom was, a disposition in the horses thus affected to place the head against the wall and to push forward with all their force, so as even to break through or overthrow partitions. They were observed to continue in this attitude, with a kind of tetanic stiffness, for above an hour, until the paroxysm of spasm subsided, when they dropped down from exhaustion. The disease always ended in paralysis, coma, and convulsions. It is one of the forms of disease known in this country by the name of staggers.

General review of the symptoms.—We shall complete the history of the different forms of cerebritis by taking a general review of the leading symptoms, pointing out at the same time the different pathological conditions of the brain with which they seem to be connected; so far at least as is practicable in the present state of our knowledge.

When the inflammation occupies at the onset a large portion of the brain, we have seen that it is generally complicated with meningitis, and characterised by disturbance in all the vital functions; that we may recognise in the symptoms a period of high excitement, and one of corresponding depression; and that it runs its course speedily, either to a favourable or fatal termination.

When, however, a smaller portion of the brain is engaged in inflammation, as in *partial cerebritis*, the course of the disease is seldom so rapid; its invasion is more gradual, and preceded by symptoms of irritation in some of the organs of voluntary motion, sensation, or intelligence; and in the more advanced periods of the disease the functions of some of these organs become considerably impaired, or completely abolished.

We have stated that, when partial cerebritis is fully established, one of the most constant symptoms of the first period is paralysis of voluntary motion, with spasmodic rigidity of the muscles, producing permanent flexion of the affected limb. The limb is sometimes considerably bent, and its extension is attended with severe muscular pains; this spasmodic action generally shows itself first in the arm, in which it is always greatest, and then extends to the inferior extremity. When the muscles of the face partake of the spasm, the mouth is drawn towards the paralyzed side; the eyelids are closed by the contraction of the orbicular muscle, so that some stiffness is felt in attempting to open them. But in the more advanced stages, when the paralysis becomes complete, and the muscles are relaxed, the mouth is drawn by the healthy muscles to the side opposite that paralyzed. The eye continues closed, but it is from the dropping of the eyelid, in consequence of the paralysis of the levator palpebræ superioris.

Convulsive rigidity and retraction of the muscles are sometimes observed in connection with meningitis; but it may be generally distinguished from spasmodic paralysis by several well-marked signs. There is no actual paralysis; and when the convulsive retraction intermits, the patient fully recovers the power of voluntary motion in the same manner as after the paroxysms of spasmodic rigidity in tetanus. This convulsive rigidity is scarcely ever limited to one region or to one side of the body, as in partial cerebritis, but affects a variety of parts at the same time on both sides. Another ground of distinction is, that the sensibility remains unimpaired. In spasmodic paralysis the rigidity and loss of voluntary motion are permanent, and the sensibility of the affected parts is more or less obtuse.

The accuracy of these rules of distinction has been considered by some as still rather doubtful, and this is a point in the pathology of these diseases requiring perhaps further investigation. We are of opinion, however, that they are not without foundation. It is true that spasmodic paralysis is a very common symptom of chronic meningitis; but it is equally certain that, if the brain be carefully examined, chronic inflammation of the membranes will almost always be found combined with inflammation and softening of the surface of the brain. These views are supported by the authority of Bayle, Laennec, Lallemand, Gendrin, and several other eminent pathologists. Spasmodic paralysis, with pain and other signs of irritation, is generally characteristic of the *first stage* of cerebral inflammation, or that of excitement: the disease sometimes terminates fatally at this period.

When the inflammation, however, advances towards the *second stage*, or that of softening and suppuration, the rigidity and muscular contraction gradually lessen, until at last there is complete paralysis. This condition of the muscles has generally been found in connexion with softening and disorganization of some part of the brain. An important difference exists, therefore, between the spasmodic and the complete paralysis: the first, being the effect merely of the compression and irritation of the cerebral substance occasioned by the great influx of blood in the first stage of inflammation, is capable of being removed, if we can only succeed in subduing the inflammatory action at an early period; the second, arising from the complete destruction of a portion of cerebral substance, is beyond hope of recovery, since there is yet no instance on record of the reproduction of brain.

When the paralysis is at first partial, and increases only gradually, the paralyzed muscles are sometimes affected with convulsive motions, generally of short duration. This usually happens when the progress of the inflammation is slow, and the diseased portion of brain is partly in the first and partly in the second stage of inflammation. When arachnitis supervenes on partial cerebritis, both sides of the body may be convulsed; but in this case, when the paroxysms of convulsion intermit, one side only remains paralyzed. Convulsions affecting both sides of the body at the same time may generally be considered symptomatic of inflammation of the membranes, rousing into inordinate activity the functions of the healthy brain, and thus exciting violent irregular action of the voluntary muscles. But, when the substance of the brain itself is extensively diseased, the power of voluntary motion is partially impaired or altogether destroyed. General convulsions may also be the effect of simple pressure or of nervous irritation; but in these cases the fever which attends arachnitis is altogether absent. In some instances one-half of the body has been violently convulsed, whilst the other has remained perfectly motionless, as if dead: this has been observed to arise from the combination of arachnitis with very extensive softening and destruction of one side only of the brain. In other cases both sides of the body have been affected with paralysis in succession; this generally indicates the extension of the inflammation from one hemisphere to the other, but these cases of double cerebritis are not common. In chronic cerebritis we have seen the paralysis assumes a different character; its invasion and progress being very slow and gradual, and not usually attended with any muscular pain or spasmodic irritation. Inflammation and softening of some of the central parts of the brain (the corpus callosum, fornix, and septum lucidum) do not occasion any paralysis.

The paralysis in the latter stages of cerebritis frequently affects the organs of speech. In some cases there is great volubility of speech; this principally happens on the approach of delirium; but more generally the utterance is slow and drawling: at first there may be only a slight defect or hesitation in pronouncing one letter or certain words; at other times the patient is affected with an entire loss of speech, either suddenly or by slow degrees. The loss of speech may proceed from loss of memory alone, the tongue remaining free; or the tongue and memory may be simultaneously affected.

Paraplegia, which had generally been considered as always the result of disease of the spine, has been observed by several writers to depend sometimes on inflammatory or organic affections of the brain alone, especially in adults. A paper will be found on this subject, by Dr. Baillie, in the Transactions of the College of Physicians, vol. vi., and one by Mr. Earle, in the Medico-Chirurgical Transactions for 1828. This subject will be more fully considered in the article PARALYSIS.

The explanation of paralysis and convulsions affecting the side of the body opposite to the diseased hemisphere of the brain, is to be found in the decussation of the nervous fibres in the anterior portion of the medulla oblongata. It takes place so invariably that it may be almost considered as a general rule; there are, however, several well-authenticated cases on record, of paralysis having occurred on the same side of the body as that occupied by the disease of the brain. M. Bayle, in the Révue Médicale for January 1826, states that he had seen two unequivocal cases of this description in his own practice, and relates eight similar cases taken from former writers; three of them from Morgagni. A case in support of the same fact has been published by Dr. James Johnson, in the first volume of the Transactions of the Associated Apothecaries. Dr. Gall and other modern anatomists have distinctly shown that the decussation of the nervous filaments in the anterior portions of the medulla (corpora pyramidalia) is not always complete, and that several of these filaments are sometimes continued from each crus cerebri along the medulla spinalis on the same side: this may afford some explanation of the cases in question, although it is not perhaps altogether satisfactory. It has been supposed by some that the decussation takes place in the corpus callosum; but this appears without the least foundation. This subject has been discussed by Dr. Yelloly at considerable length, in a paper published in the first volume of the Medico-Chirurgical Transactions.

Next to the affections of voluntary motion, loss of sensibility is one of the most prominent symptoms of cerebral inflammation: the two classes of symptoms are generally combined, but seldom manifest themselves exactly at the same time. The paralysis of the skin usually appears later than that of the muscles, so that an extremity may have lost the power of motion, while it still preserves some degree of feeling. The sensibility, however, gradually decreases, until at last it becomes very feeble or totally abolished. The arm is generally deprived of motion before the leg; and the loss of feeling follows in the same order. The loss of voluntary motion alone indicates a less complete degree of paralysis than when combined with loss of feeling. There are some interesting facts connected with the loss of feeling as well as with diminution of temperature, which we shall have occasion to consider more in detail in the article PARALYSIS.

This account of the symptoms derived from the affections of voluntary motion and sensation has been deduced from a careful examination of a large body of well-observed facts collected by others, as well as from our own experience. It is necessary, however, to keep in mind that the accurate study of the symptoms in cerebral diseases is too often surrounded with many difficulties and sources of error. The patient is sometimes in the situation of a child, unable to explain his sensations, either past or present; the obtuseness or total loss of consciousness, preventing the free and full development of the symptoms, alters or completely conceals the true character of the disease; the absence, therefore, of any of the leading symptoms, in one case, under such circumstances, is not to be taken as a proof of their fallacy in every other. Several of the symptoms, spasms and convulsions for instance, may be so evanescent as to escape superficial observation. An accurate knowledge of the comparative state of the different regions of the body with respect to sensation and motion is sometimes attended with great difficulty, and requires the most careful examination. We cannot always see the patient in motion so as to judge of the exact degree of power he possesses over the different muscles; we must then make him grasp or lift a body. The state of feeling and of heat in each region should likewise be accurately noted. We feel strongly convinced that numerous mistakes are committed in all these respects by a hurried and superficial observation; and we need no better proof of the truth of this assertion than the very imperfect manner in which many of the cases on record are reported, some of the most important facts being frequently altogether omitted. It is always of considerable importance to obtain, if possible, a correct account of the history of the case from the earliest appearance of the symptoms; for it is chiefly from the mode of invasion that the different forms of cerebral inflammation derive their distinctive character, as they assume a greater resemblance to each other in their latter stages.

We have noticed, among the symptoms of

acute cerebritis, paroxysms of increased activity of the external senses and intellectual faculties, such as intolerance of light, tinnitus aurium, violent delirum. The pupils are contracted during the period of excitement, but resume their natural size when it subsides; this distinguishes cerebritis from sanguineous apoplexy, in which the pupils are almost always dilated. Sometimes there is dilatation of one pupil and contraction of the other; the pupil, whether contracted or dilated, may be immovable, which is always an unfavourable symptom. Acute delirium and intense headach are more common attendants on the combined inflammation of the brain and its membranes than on that of the brain alone. Inflammation of the membranes, extending only to the surface of the brain, excites a considerable degree of sympathetic irritation and general disturbance in the cerebral functions, which, however, continue unimpaired so long as the organs remain healthy; but when the substance of the brain itself is deeply or extensively inflamed, its functions are rather oppressed and impeded, in proportion to the extent of the disease, than highly excited.

Partial and chronic cerebritis is scarcely ever attended, in its first stage, with general excitement of the cerebral functions. When the sight or hearing is affected, it is on one side only; the intelligence is rather partially weakened than excited. Cephalalgia is not so constant in cerebritis as in affections of the arachnoid and dura mater. There may, however, be a local fixed headach, sometimes intermitting; but the pain subsides as the disease advances and the brain becomes more deeply affected; headach, therefore, is a less unfavourable symptom than stupor. In some cases the pain has been felt on the side opposite to the disease, an anomaly not easily explained. In the latter stages of partial cerebritis the senses and intellect become more seriously impaired, the patient falling either suddenly or gradually into a state of coma, or being cut off by an attack of meningitis.

It has been generally remarked that inflammation of the brain alone does not occasion much disturbance of the circulation, as large portions of brain have been destroyed by suppuration, in injuries of the head, without any disturbance of the pulse or general re-action. This has been accounted for by the heart receiving its nerves chiefly from the great sympathetic, and being only indirectly influenced by the brain. The high fever accompanying some cases of cerebritis is to be ascribed generally to the complication of the disease with arachnitis, or with inflammation of some other organ. Great and sudden variations have been noted in the frequency of the pulse in very acute cases; it sometimes suddenly rises from 100 to 160; at another time it may be irregular or intermitting, or so feeble and slow as scarcely to be felt; and again quickly recovering its strength and frequency. These changes in the pulse correspond with the alternate paroxysms of excitement and collapse, and are connected, as will be seen presently, with similar changes in the respiration.

The respiration is not in the least disturbed in the great majority of cases of simple cerebral inflammation. This is satisfactorily accounted for by Sir Charles Bell's interesting discoveries respecting the origin and functions of the respiratory system of nerves: large portions of the brain may be destroyed, and extensive regions of the body deprived of sense and motion; but as long as that portion of the medulla which gives origin to the nerves of respiration continues free from irritation, inflammation, or pressure, the functions both of the respiratory and circulating systems proceed without interruption, and life is sustained. When, however, the inflammation or general irritation extends to the medulla, as happens in the paroxysms of convulsions which sometimes occur in cerebritis, the respiration then becomes extremely hurried; the violence of the convulsions forces also the blood towards the heart, which is excited by these two causes to redoubled action, in order to relieve itself of the congestion by which it is oppressed; hence the rapidity and sudden rising of the pulse: as soon, however, as the paroxysm subsides, the respiration and the pulse become comparatively tranquil. When the medulla is exposed to pressure, the respiration is slow, laboured, and stertorous.

Difficulty of breathing is on many occasions the effect of mere cerebral irritation, and there is in reality a *cerebral dyspnœa*, which we have no doubt has sometimes been mistaken for disease of the lungs. This difficulty of breathing is distinguished by its frequency, its irregularity, and a kind of hysterical sighing; or it is slow, laboured, and stertorous, as in coma. Auscultation will be found an invaluable resource in all cases of doubt; an accurate diagnosis in this respect is of the first importance, especially in the latter stages of continued fever.

The functions of the digestive system are so much under the influence of the brain, that they must obviously sympathize with its diseases; the sensations of hunger and thirst, for instance, being greatly modified by the various conditions of that organ. Thus, in cerebritis the appetite is in general deficient, and the digestion slow and imperfect, especially in the more chronic forms; there is also a great disposition to sluggishness and constipation of the bowels; and the stomach itself is sometimes so torpid, that the strongest emetics are insufficient to excite vomiting. In other cases, however, there is considerable irritability both of the stomach and bowels, with vomiting or diarrhœa, and a very unhealthy state of the secretions; this chiefly happens in children. We have already sufficiently pointed out the influence of cerebral affections on the urinary organs, and the necessity of great attention to the state of those organs when the functions of the brain are much disturbed.

The convulsions, paralysis, and other pathognomonic symptoms of cerebral inflammation, may be referred to the more immediate action of three causes:—1st, *inflammation* affecting either the membranes or a portion of the substance of the brain: 2d, *nervous irritation* extending from the diseased to the healthy parts of the brain, and stimulating its functions: 3d, *pressure*. The difficulty in ascertaining from which of these causes the various symptoms arise, constitutes the chief obstacle to our always forming an accurate diagnosis in cerebral diseases. Convulsions, spasmodic paralysis, increased activity of the intellectual faculties and external senses, delirium, and all symptoms of excitement, may generally be considered to indicate either commencing inflammation or nervous irritation in the substance of the brain or its membranes. Convulsions may also arise from pressure alone, although paralysis is its most frequent effect; but the absence of all fever and other symptoms of general irritation, will distinguish these convulsions from those of arachnitis and cerebritis: the same distinction applies to the convulsions of a purely nervous character, observed in hysteria, and after the use of certain poisons, &c.

The effects of pressure have often been examined by experiments on animals. If the cranium of a dog is trepanned and pressure performed on the dura mater to a certain extent, the animal shows signs of great uneasiness, and is affected with general convulsions; if the pressure is increased, the convulsions cease, the breathing becomes stertorous, the animal torpid and comatose; if the pressure is diminished, the breathing becomes more free and the convulsions return; and if it is entirely removed, the animal soon completely recovers. The principal causes of pressure are congestion; effusion of blood, pus, or serosity into the ventricles, between the membranes, or in the substance of the brain; organic diseases of the brain or cranium. The obscurity in which all these interesting questions are still involved, is capable, we think, of being considerably lessened by further investigation; and nothing would be more likely to contribute to so desirable an end, than pathological observations made with care and impartiality. A valuable collection of cases illustrating the consequence of pressure on the brain, will be found in Dr. Bright's Reports of Medical Cases.

Some important information is afforded on the modifications produced by pressure in cerebral diseases, by the results observed to follow injuries of the head. Many interesting cases of this description are recorded in medical and surgical writings.

It is a matter of general observation in injuries of the head, that when there is an external opening forming an outlet for the pus, extensive inflammation and suppuration of the brain may take place, with only very slight paralytic and other symptoms, compared with those which arise from spontaneous inflammation of a much more limited extent. In confirmation of this we shall adduce the extraordinary case mentioned by Mr. O'Halloran. A man, after an injury of the head, lost a considerable part of the frontal bone on the *right* side; a great opening was formed, and extensive suppuration having taken place, there were discharged through it at each dressing immense quantities of purulent matter, mixed with large pieces of cerebral substance, emitting a horrid smell, and making, after some time, "a frightful cavern" in the very substance of the brain. On the *eighth day* of this affection, the *left* hand and arm became paralytic, and the *left* thigh and leg on the *tenth day:* the man lived to the seventeenth, retaining his faculties to the very moment of dissolution, and having continued through the whole course of the disease perfectly composed and intelligent, and with a pulse quite natural. Mr. O'Halloran says that he could affirm that no less than three ounces of the brain followed every dressing after the eighth day. These facts clearly prove the great share which pressure has in the production of the fatal consequences attending inflammatory affections of the brain. They enable us to understand how the swelling of one portion of brain, in the progress of inflammation, may be sufficient to exercise considerable pressure on the whole organ; hence the occurrence of complete hemiplegia with disease only of a small portion of brain; and that likewise of convulsions, paralysis, affections of the external senses on both sides of the body, and coma, with disease on one side only of the brain. That there is a considerable tendency in the cerebral texture to expand and swell under inflammation, is made evident by the great protrusion of the brain through the openings in the skull which sometimes takes place after injuries of the head. The effects of pressure are local or general, according to its degree: when slight, it may excite convulsions; when great, it suspends consciousness and paralyses motion; if long continued, it destroys life by interrupting the circulation in the brain.

Morbid Anatomy.—Before proceeding to the description of the different morbid conditions of the brain, it may be useful to state that there are several appearances depending on accidental circumstances, which it is important not to mistake for the effects of disease. In persons who have died of acute disease, the brain is more injected than in those who have died of chronic; the injection is much greater also in cases of death from asphyxia or after violent convulsions. In chronic diseases the brain is often very soft and flaccid, whilst in acute diseases, where death has taken place rapidly, its density is rather increased.

After removing the membranes from the surface of the brain and cutting it in slices, a long exposure to the air is followed by a considerable increase of redness. If, as frequently happens, the head of the subject has been placed in a dependent position, a considerable degree of injection and of uniform redness may be the result, in consequence of the gravitation of the blood, and of its oozing through the pores of the vessels; the brain has then an appearance as if stained or washed with blood: the same takes place when the post-mortem examination is delayed until a considerable time after death, and putrefaction has already commenced: it occurs also more readily in hot weather and after malignant diseases. But this kind of accidental injection and redness of the brain differs so greatly from that which is the result of disease, that it is scarcely possible to mistake the one for the other; in the former case the blood will be much more easily removed by ablution in water, than in the latter.

It is important also to notice that a very great difference is produced in the vascular turgescence and redness of the cerebral substance, according to the order in which the cavities of the head or thorax are opened. When the thorax is first opened, it is evident that the vessels of the head and brain must be drained of some of their blood, in consequence of the large vessels of the lungs and heart being emptied. The brain will therefore always appear more loaded with blood, when the head is opened before the other great cavities. Finally, when the hammer is used to open the cranium, a certain degree of redness and ecchymosis is always produced round the line of fracture by the concussion, which might, through inattention, be mistaken for disease.

There can be no difference of opinion respecting the appearances which indicate inflammation of the brain in its advanced and confirmed stages; but the case is very different as regards incipient inflammation. Pathologists are not yet perfectly agreed upon the exact appearances which constitute the commencement of inflammation in the brain, or any other organ: this has at all times been a fertile source of error in the history of diseases, cases of mere congestion having often been erroneously described as inflammation. The celebrated Laennec was perhaps justified in his opinion that, as a general rule, the deposition of a new product in any texture, such as pus or coagulated lymph, was the only genuine and incontestable proof of the previous existence of inflammation. Inflammation is, however, always necessarily preceded by an increased flow of blood to the part; and, by a timely removal of the exciting cause, this congestion may subside without passing into inflammation; but it is obvious that there must always be considerable difficulty in drawing the exact line at which congestion ceases and inflammation begins, or the physiological condition of the brain becomes pathological; nor is this indeed at all necessary for practical purposes. These observations will show the importance of guarding against the too common practice of setting down as decided inflammation every appearance of redness and increased vascularity. We have no doubt that mere cerebral congestion has often thus been mistaken for inflammation.

Congestion.—In cerebral congestion [*cerebral* or *encephalic hyperæmia.*] all the vessels on the surface of the brain are more injected than usual, and it is easy to trace their minute ramifications. The substance of the brain, when cut through, presents a greater number of red dots, especially in the cineritious substance; but between these red dots the brain preserves its natural colour: its texture is not in the least altered, and this increased vascularity is general.

Cerebral congestion assumes sometimes another appearance, that of uniform redness, which, however, is never general. The white substance presents a light rose-colour, sometimes a deep red tint not unlike mahogany; the grey substance, in which it is more frequent, assumes a reddish or scarlet tinge; the shades of red vary however, being described as purple, violet, chocolate, &c. M. Billard observed a slate-coloured tint in the cortical substance of the hemispheres in two individuals who had presented signs of chronic irritation of the brain. This uniform discoloration is only found in patches in different parts of the brain: it might not inaptly be compared to that condition of the lung which leads to pulmonary apoplexy, and it may likewise lead to cerebral hemorrhage, either by the exudation of blood or rupture of vessels. An uniform blush of a rose-coloured tint or of a deeper red frequently surrounds apoplectic clots of blood, or softened portions of brain.

Cerebral congestion almost always accompanies inflammation of its membranes, and this affords an explanation of several of the symptoms. In some instances there is an effusion of a turbid or limpid serum into the ventricles, or between the arachnoid and pia mater; in others the arachnoid is, on the contrary, remarkably dry.

The character of congestion varies according as the arterial or venous system is most involved in the morbid action. A loaded condition of the venous system is common in old people, in persons affected with disease of the heart, or any other complaint preventing the free return of blood from the head; in those also who die of asphyxia, or whose last moments are attended with violent and long-continued struggle. Venous congestion is not so frequent an attendant upon inflammation as the arterial; they are distinguished from each other by the darker colour of the venous blood, and the evident greater distension of the veins and their sinuses. The quantity of venous blood poured out is sometimes very considerable.

A high state of congestion, either general or local, precedes inflammation. General congestion may cause death, either by compression or the extravasation of blood, before there has been sufficient time for the development of inflammation. Local congestion is seldom so rapidly fatal, and time is afforded for the inflammatory process to go through its different stages.

Inflammation.—The first and most simple stage of cerebral inflammation is characterized by a high degree of vascularity and a red florid injection of the cerebral substance. When cut through it presents a considerable number of red dots, out of which oozes blood, the naturally colourless capillaries being filled with blood. Besides these red dots, there are other small spots, in which, owing to the rupture of the capillaries, the pulp is infiltrated with blood; these spots or stains are striated, resembling ecchymosis: when numerous, they give the cerebral substance a marbled appearance, with various tints of red,—the cineritious substance of a deep red, the white substance of a marbled violet. The intensity of the redness generally decreases from the centre to the circumference of the inflamed portion. Several of these spots of ecchymosis sometimes unite, and form a small coagulum of blood; the diseased portion of brain is rather firmer than usual, owing to the turgescence of its vessels, and has less tenacity. All the preceding appearances will be more or less strongly marked according to the intensity of the inflammation. They may occupy a considerable portion of one of the hemispheres, or a number of circumscribed spots in different parts of the brain, extending more or less in depth. If the inflammation be extensive, and combined with arachnitis, it may prove fatal in this stage. When more limited, its progress is not so rapid, and it generally passes into the second stage or that of softening.

Softening, [or *Ramollissement.*]—In the second stage of inflammation, the substance of the brain becomes completely infiltrated with either blood or pus, or both; its delicate texture is broken down, softened, and more or less diffluent. When blood predominates, this constitutes the *red softening.* The colour of the broken-down pulp varies from a bright red to a wine-lee tint, with intermediate shades of claret, brown or ash. In the cineritious substance it is of a reddish grey or brown, from the mixture of grey substance with the blood; all traces of fibrous texture disappear. The pulp in the centre of the diseased portion is diffluent, and contains sometimes loose turgid vessels; whilst towards the circumference it is firmer, deeply injected, and presents the character of the first stage of inflammation. There may be several softened-down spots, and small clots of blood may be found in the softened mass; the surrounding brain presenting sometimes a serous infiltration or a kind of œdema.

When purulent softening takes place, globules of pus are seen mixed up with the deeply-injected pulp, giving it a greyish or yellow colour. As the disease advances, the purulent infiltration becomes general, and presents a softened mass, consisting of pus mixed up with brain. This constitutes the *yellow softening*. The same diseased portion may show the different stages of inflammation: the red and hardened state at the circumference; that of semi-purulent infiltration next; and the diffluent purulent softening in the centre. The infiltration of pus may take place very irregularly throughout the same inflamed portion: it may be of various degrees of consistence; semi-concrete, in a state of jelly, or that of a thick fluid. The pus has sometimes fused from the diseased into the healthy brain, forming for itself a new cavity. The red and the purulent softening are frequently combined, one portion of the inflamed part presenting a sanguineous infiltration, and another a purulent; or else there is a general mixture of blood, pus, and brain, of a dirty grey or reddish colour. It is evident that the colour of the inflamed brain must depend on the nature of the fluids, whether blood or pus, with which it is injected, and on the proportion in which these fluids are mixed.

The cineritious substance is the most frequent seat of the red softening; its great vascularity strongly predisposing it to inflammation. Thus, of forty-six cases of cerebritis collected by Lallemand, the grey substance was the principal seat of the inflammation in thirty-three, and the medullary in only eight. The surface of the convolutions, which consists entirely of cortical substance, was affected in sixteen cases; the corpora striata and optic thalami, in which the grey predominates over the white substance, in thirteen; and the tuber annulare, which contains less of grey substance, only in four. Some influence must be allowed to the greater extent of surface of the cortical substance, and to its connexion with the arachnoid.

The softening in some cases is of a uniform yellow or greenish colour, with only a blush of red at its circumference, and the appearances of a less acute degree of inflammation. This is the form in which it is most generally found in the medullary substance, which is much less vascular, as already stated, than the cortical.

There is a variety of cerebral softening very distinct from the preceding, and which is called the *white softening;* it affects more particularly the medullary substance. The pulp seems broken down by a kind of serous infiltration, and presents the appearance of whipped cream, with a few drops of pure serosity sometimes intermixed. The colour is generally of the purest white, at times, however, inclining to grey or yellow, especially when seated in the cortical substance: it is not surrounded by increased vascularity or redness, but rather by a state of œdema of the adjacent brain. This is the simplest form of softening of the brain, and that most common to old people; it is generally attended with serous effusions in other parts of the brain, and also with disease of the arteries, which is supposed to be one of its principal causes. The coats of the arteries are either ossified or affected with earthy brittleness; their tubes sometimes very much narrowed or obliterated, or else having a succession of small bony rings; the inner coat is in some cases thickened, soft, and easily separated. The basilary arteries are the most subject to these changes of structure. The veins have also been found diseased. Dr. Cheyne has seen a case (*Abercrombie*, Pathological Researches on the Brain) in which there was a deposition of a firm yellowish white substance between the two coats of the veins, and this extended to all the veins of the brain; there was a turbid effusion between the arachnoid and pia mater; the whole brain was bloodshot: there was a portion of softened brain on the side of the left ventricle, an inch in length, with a cavity in its centre: the patient had long suffered from headach, and died apoplectic. The white softening must not be confounded with that softness and flaccidity of the entire brain which occurs after cachectic diseases, or those attended with great prostration of strength and symptoms of putridity.

Softening of the brain sometimes occurs round a clot of extravasated blood: this may take place consecutive to the extravasation, as the effect of inflammation excited around it; or else the softening may have existed previously, and the extravasation have been occasioned by the ulceration and rupture of blood-vessels in the centre of the broken-down brain: we shall consider this more fully hereafter. Softening of the brain is frequently observed round organic tumours, as the result also of secondary inflammation.

With regard to the seats of softening, the surface of the convolutions, the optic thalami, corpora striata, and medullary centres of the hemispheres, are the most ordinary seats of cerebritis. It is less frequently met with in the corpora quadragemina, crura cerebri, cerebellum, medulla oblongata, and spinal cord; it is in fact most frequent in those parts of the brain which have the largest share of cortical or cineritious substance, because that substance, as observed before, is considerably more vascular than the medullary. The cortical substance of the convolutions is sometimes extensively softened, whilst the white substance beneath remains untouched; this may happen in arachnitis. The white softening of the brain, which is less decidedly inflammatory, is most frequently found in the medullary substance.

[M. Durand-Fardel (*Traité du Ramollissement du Cerveau*, Paris, 1843,) found acute softening by far most frequently in the convolutions. Of 33 cases, 31 were examples of this seat of the disease, and in 9 the convolutions were alone affected. 53 cases, collected from various sources, gave the following results as regards the seat of the lesion.

Convolutions and medullary substance	22
Convolutions alone	6
Medullary substance alone	5
Corpus striatum and thalamus opticus	6
Corpus striatum alone	11
Thalamus opticus alone	4
Pons Varolii	3
Crus cerebri	1
Corpus callosum	1
Walls of the ventricles, septum	1
Fornix	1
Cerebellum	1

Chronic softening appears to affect the convolutions, corpora striata, and optic thalami, in the same proportion as the acute.]

Some of the central parts of the brain, such as the corpus callosum, septum lucidum, and fornix, are often affected with softening in hydrocephalus. In one of Dr. Abercrombie's cases there was a ragged irregular opening in the septum lucidum, and the opening was surrounded by a ring of inflammation; the inner surface of the ventricles was in a state of high vascularity; they were distended with colourless fluid, and the substance bounding them was in some places considerably softened. The softening is sometimes confined to the corpus callosum. It is evidently the result of a serous infiltration of the medullary matter, whether the serum be poured out as the consequence of inflammation or the reverse. This form of softening is repeatedly alluded to by Morgagni, and by most authors who have written on hydrocephalus. Dr. Abercrombie divides hydrocephalus into two species; one depending on simple inflammation of the lining membrane of the ventricles; the other attended with inflammatory softening of the corpus callosum, fornix, and septum lucidum, and also of the cerebral substance forming the walls of the ventricles; the latter species he believes much the most frequent, and he is decidedly of opinion that hydrocephalus is an inflammatory affection of the central parts of the brain. He maintains, also, that the effusion, which was hitherto considered as the cause of the disease, is merely one of its terminations, contributing, however, by the increased pressure it occasions, to aggravate the symptoms.

The softening of the central parts of the brain appears to be sometimes connected with diseases of debility, as likewise the serous effusion which accompanies it: this is found to be the case principally in old paralytic people, and in those labouring under dropsy and other lingering diseases. It is ascertained by numerous observations that these central parts of the brain may be affected with softening, even to a considerable extent, without occasioning paralysis in any region of the trunk: these parts seem chiefly intended to connect together the hemispheres, and have very little communication with the medulla oblongata. There are few cases on record in which this variety of disease has proved fatal without any serous effusion or other morbid alteration, although the actual symptoms of effusion were present. This is, however, of such rare occurrence, that no practical conclusion can reasonably be deduced from it.

[In 32 cases of acute softening, recorded by M. Durand-Fardel, (*op. cit.*) paralysis was present in 23 cases. In two cases, it was general; in one, there was simply weakened power of motion; in 6, the paralysis was limited to the arm, and in 14, it affected one entire side. At other times, instead of the limbs being paralysed, they are more or less rigid and contracted. Cases are on record, and the writer has met with such, where the intellect was unaffected, although the softening was great. One of the most interesting examples of the kind was communicated in a letter to him, by Dr. Boerstler, of Lancaster, Ohio, (*American Medical Intelligencer*, April 1837.) In this case, the portion of the skull, previously occupied by the right anterior and middle lobes of the brain, presented a perfect cavity, which was filled with some sero-purulent matter; and the left hemisphere was in a state of softening down to the corpus callosum. It was so much softened, that the slightest touch would remove portions; yet, in his daily visits to the subject of this case, Dr. Boerstter could not discover any derangement of the intellectual faculties, dulness of sensibility, obtusenes of perception, impairment of judgment, or want of memory. Such cases can, however, only be regarded as anomalies.

The writer has elsewhere (*Practice of Medicine*, 2d edit. p. 187, Philad. 1844) referred to the case of a gentleman, who possessed his sensation, volition, and mental and moral manifestations entire, even when a clot of blood existed in the corpus striatum with extensive softening around it.]

General softening of the brain is stated by Andral to be exceedingly rare in adults, but to occur sometimes in new-born infants. In thirty cases of pultaceous softening of the brain, observed by M. Billard, there were ten in which the affection extended also to the whole of the spinal cord; and in each of these ten cases the odour of sulphuretted hydrogen was perceptible. The infants in whom this alteration was observed lived for some days after birth, but their respiration was laborious and imperfect, their limbs were flaccid and motionless, and the pulsations of the heart scarcely perceptible. It appears also, from the labours of M. Billard, that softening of the brain is most frequent in old people, and next to them in adults. It is rather uncommon between the ages of fifteen and twenty, but becomes less so between two and fifteen; it may occur immediately after birth, and is then more considerable and extensive than at any other period of life: it is probable indeed that in some cases it begins even before birth.

Having thus far described the morbid alterations of the brain arising from inflammation, it seems desirable to inquire briefly into the nature of these changes, and into the various opinions entertained respecting them by medical writers.

It is not a little remarkable that the peculiar morbid condition of the brain termed softening, which has, with few exceptions, been overlooked by pathologists in both ancient and modern times, should not have escaped the attention of the great founder of the medical art. Hippocrates, (lib.

iii. de morbis, tom. ii. p. 96, edit. of Vander. Linden), gives an exact, although short, description of cerebritis, under the name of œdema of the brain: this wonderfully acute observer seems to have justly appreciated its true character, for he states that this tumefaction of the brain is an inflammatory disease, for which he recommends bloodletting. Morgagni, Bonetus, Lieutaud, Jemima, in their accounts of softening of the brain, describe it as a broken-down putrilage—corroded—consumed—and consider it analogous to gangrene in other tissues. Dr. Baillie concurred in this opinion, which has also been adopted by Dr. Abercrombie. The latter considers softening of the brain as the death of the affected portion, and that, like gangrene, it may arise from two opposite causes—from excessive action, which includes the cases with appearances of vascular injection, suppuration, &c. and from deficiency of action, owing to a failure of the circulation, which includes the cases of white softening with disease of the blood-vessels. Among the French writers, M. Recamier considers softening of the brain as a change of structure *sui generis*, distinct from any other, analogous to softening of the spleen, and the primary cause of certain forms of nervous fever. Lallemand [and Durand-Fardel] conceives it to be always an inflammatory affection, passing through the different stages of tumefaction and suppuration, like phlegmon. Rostan adopts quite an opposite opinion, that it is a real gangrene of the brain, (*gangræna senilis*,) depending on a diseased state of the blood-vessels: this opinion may partly be accounted for by the circumstance of his observations being chiefly collected in the wards of the Salpetrière, which is an asylum exclusively for old people. Laennec, who had paid great attention to this subject, was of opinion that softening of the brain was of two kinds—the one inflammatory, in which pus, either fluid or concrete, was deposited in the cerebral substance, constituting the yellow or reddish softening; the other (the white softening) depending on an infiltration of the cerebral substance with destruction of its cohesion by serous fluid, forming an œdema of the brain. He observed another species of œdema, without destruction of substance, surrounding sometimes inflamed portions of brain, resembling the œdema so common in the neighbourhood of phlegmonous tumours.

If we turn from these opinions to an attentive consideration of what is exhibited by dissection, we shall find that in all the forms of disease which have been described, the substance of the brain is infiltrated either with blood, pus, or serum, or with various combinations of these fluids. The cerebral pulp being provided with only a very small proportion of cellular tissue, and that of extreme delicacy, it is easy to conceive that it should soon become lacerated by the deposit of any considerable quantity of fluid between its fibres and laminæ; the pulp is then broken down and mixed up with the interposed fluid. The most rational explanation of cerebral softening would seem therefore to be, to consider it not as a specific disease, but as the result of changes of structure following certain morbid conditions of the brain, nearly similar to those which occur, under similar circumstances, in other organs; and with only such modifications as are satisfactorily accounted for by the natural difference in its texture. In the phlegmonous inflammation of other organs, the parts affected are to a certain extent lacerated, broken down, and destroyed, previous to the formation of an abscess, although this may not take place so rapidly as in the brain, the parts offering a greater degree of resistance.

One of the effects of inflammatory action is ultimately to destroy the cohesion of tissues, although in some of them their firmness may at first, in consequence of the distension of vessels or deposition of concrete lymph, appear increased. Some pathologists having erroneously considered hardness and cohesion as always synonymous, have asserted that it is the property of inflammation to soften hard tissues and harden soft ones. This is a complete fallacy. A portion of inflamed lung in the second stage appears firmer to the touch than healthy lung, and yet by a slight pressure of the fingers its texture immediately breaks down; it is found brittle; the cohesion of its parts is greatly weakened; and it has lost its tenacity. The cohesion of tissues is equally lessened by cachectic diseases and watery effusion. But it may be asked, since the organization of the brain is broken down and destroyed, is not this gangrene? It has just been stated that in the process which leads to the termination of phlegmon in healthy suppuration, the central parts of the tumour are broken down and disorganized; a large cavity is formed with loss of substance; and yet this is not looked upon as gangrene, and differs very widely from the termination of the same tumour in gangrene: in fact, the term gangrene cannot, strictly speaking, be applied to every case of disorganization and loss of substance. There is in parts affected with gangrene a tendency to rapid decomposition; a putrescence, exhaling a specific fœtor, known by the appellation of gangrenous, which does not belong to suppuration, and has only occasionally been observed in spontaneous softening of the brain. Genuine gangrene of the brain is stated by most medical writers to be a rare termination of inflammation of this organ. Laennec* says he has very seldom met with it; Bayle gives an account of *one* case of white softening with apoplexy and gangrene; Dr. Abercrombie, in two or three of his cases, speaks of the softened brain mixed with pus having an intolerable fœtor, and these were probably cases of true gangrene. In a case mentioned by Sauré, after acute cerebritis occasioned by a blow on the head, the membranes of the brain were of a livid colour for an extent of several inches, and the brain beneath was very black and gangrenous to the depth of several inches. The most numerous accounts of undoubted gangrene of the brain are those found in surgical works treating of wounds of the head with protrusion of the brain, and also of polypous excrescences of the brain protruding through the skull, and terminating in gangrene: in these cases the cerebral substance has been found of a purple red or blackish grey, considerably softened, and exhaling an ammoniacal fœtid odour.

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* The writer of this article has heard Laennec state that he and Bayle had made together five thousand post-mortem examinations.

Suppuration and Abscess.—The next variety of morbid change in the brain incidental to inflammation, and which generally follows the preceding, is the passage of the inflamed portion of the brain to complete suppuration and abscess. The globules of pus contained in the softened brain gradually unite and form homogeneous purulent collections: these are either recent and undefined, or of long standing and encysted. In the undefined abscess the pus is only circumscribed by the cerebral substance, which is partially softened down, and forms a cavity with irregular walls. The pus is generally mixed with shreds of softened cerebral substance; it varies in colour and fluidity: it is either yellow, greenish, or brown; sometimes, as Laennec states, partially concrete, like coagulable lymph, and floating in a thinner fluid; at others nearly homogeneous. Its smell is usually that of genuine pus, at times, however, emitting a peculiar fœtor.

The formation of a cyst takes place in the brain by nearly the same process as in phlegmon; the ragged sides of the cavity are lined with successive layers of coagulable organized lymph, whose delicate vessels form a union with those of the brain, and become thus connected with its circulation. The first layers are thin and delicate, but others are superadded as in the adventitious membranes of serous tissues, until the walls of the cyst become firm and perfectly organized; the internal surface is smooth and somewhat analogous to the structure of mucous membranes. Sometimes, however, the sides of the cyst are fibrous, cartilaginous, or incrusted with a calcareous deposit. It would appear from numerous observations that the rudiments of the cyst have been found as early as the end of the first week; it gradually acquires its completion, and is perfectly organised between the third and fourth week. It sometimes continues increasing in thickness for years; and some estimate may be formed of the length of time the abscess has existed, by the number of layers in its cyst. These facts have led to some important practical conclusions in cases of medical jurisprudence. An instance of this kind is related by Lallemand (Lett. IV. p. 87) in which the physicians, consulted by a court of justice, were enabled to decide that the death of a man, which was supposed to have been occasioned by the beating he received from another who was on his trial for murder, was distinctly to be attributed to chronic inflammation of the brain combined with otitis. Encysted abscesses are sometimes the consequence of acute, and at others of the more slow and insidious forms of cerebritis: the pus, being once circumscribed, is prevented from extending its ravages; and the life of the patient may be prolonged for years, exactly as in the case of an organic tumour. When the cyst finally becomes the cause of death, it is by exciting fresh inflammation in the surrounding cerebral substance; or it may give rise to arachnitis and serous effusions, or to sanguineous apoplexy. The symptoms which attend chronic encysted abscesses sometimes resemble those of organic disease.

Our attention is directed here to a rather interesting question.—Do abscesses of the brain ever heal, like those of other parts? There are sometimes found in the brain appearances of large cicatrices: they have in general been attributed to the closing up of cavities which contained apoplectic clots of blood. Lallemand and other writers are of opinion that a similar healing process may take place in encysted abscesses, after the absorption of their pus; and that these are not always to be considered as incurable. This appears by no means improbable, and is rather confirmed by the circumstances of the walls of encysted abscesses being sometimes united by transverse organic bands, which give them a cellular appearance.

Suppuration may take place very rapidly in the brain; Laennec says he has known pus to form in less than twenty-four hours; and Dr. Abercrombie mentions two remarkable cases, in one of which three well-formed encysted abscesses were found in the brain, after an illness of twelve days; and in the other several small undefined abscesses at the end of four days' illness. Cerebral abscess being one of the terminations of inflammation in that organ, is attended with the same symptoms as those belonging to the periods of excitement and softening already described; they vary only according to the character, more or less acute or chronic, and the seat of the inflammation. There are a great many interesting cases of abscess recorded in the writings of Lallemand, Abercrombie, Rostan, and of some of the ancients.

There are a few cases on record of extensive suppuration having taken place in the brain without the manifestation of any symptoms indicating such a disease, until immediately before death. Objections have been raised from this occurrence against the value of any rules of diagnosis: it should be observed, however, that such cases are rare, and that some of them are so superficially described, as greatly to invalidate the weight of their evidence. The best authenticated is one by Dr. Broussais, of a man in whose brain an extensive abscess was found in the centre of each hemisphere, and in whom no other symptoms had been observed during life than a peculiar dulness of manner and taciturnity, which terminated in coma after thirty-seven days' illness. A solution might be given of these cases by conceiving a portion of brain to have been for a considerable time in the first stage of low inflammation, which may exist without giving rise to any well-marked symptoms, until, from the sudden influence of some strongly-exciting cause, it is made to pass rapidly into the stage of softening and suppuration. The great rapidity of the formation of pus in the brain has already been alluded to. But after all, why should not latent diseases occur in the brain as well as in other organs?

Abscesses have also been found in the cerebellum, but not so frequently as in other parts of the brain. Abercrombie gives the remarkable case of a young girl in whom the left lobe of the cerebellum was entirely converted into a bag of purulent matter of a greenish colour and intolerable fœtor; it was contained in a soft and organised sac. The symptoms were intense head-ach for several days; a sudden rising of the pulse to 160; dilated pupil and strabismus; great debility and loss of the power of swallowing; she was nearly suffocated each time she attempted to drink. She died of exhaustion on the fifteenth day. Inflammation and softening are not, however, so frequently observed in the cerebellum as in other parts of the brain. The diagnostic symptoms are in general very obscure; the intellectual faculties are generally less affected than when the disease is situated in the cerebrum.

Ulceration.—This state of the brain has been described by several writers, although it is uncommon. It has been found on the surface of the convolutions, on the optic thalami, and the corpora striata. The ulcers present an irregular surface, covered partially with either a bloody or albuminous exudation, and having jagged edges. In some cases it is hard and dry; in others there are fistulous communications between the ulcer and deep-seated collections of pus; and in others the ulcer forms the bed of a coagulum of blood: the ulcers vary in depth and dimensions. Some writers consider these ulcerations as affecting more particularly the arachnoid and pia mater, and not belonging to the cerebral substance. This may be true in some cases, but not in all. Morgagni speaks, in one of his cases, of an erosion of the corpus striatum, and in another of an ulcerous cavity at the base of the left ventricle. Two cases of the same nature are recorded by Scoutetten.

There are also ulcerations occasioned by the penetration of foreign bodies, of which many cases are given by Morgagni and other surgical writers, but these are foreign to our present purpose.

Induration.—This is mentioned by Abercrombie, Andral, Bouillaud, Lallemand, and others, as an occasional termination of cerebritis. The induration may be general or partial, and of different degrees of density, from that of wax to that of fibro-cartilage.

General induration has been observed in persons affected with ataxic fever, and in some who have died in a state of general convulsion from the poisonous effects of lead: it is not uncommon also in lunatics. The brain contains little or no blood, is of a bright whiteness, and the medullary substance more condensed than the grey: the exact nature of this form of induration is yet but imperfectly known.

Partial induration is of more frequent occurrence. The simple chronic inflammation may, in some instances, terminate in induration of the portion of the brain affected. The fluids contained in the vessels, or exuded between the fibres and laminæ, whether blood, lymph, or pus, become concrete, and continue so for a longer or shorter time. The part, when cut into, is as firm as flesh or kidney; either of a bright or dark red, or yellow; or else a slow process is carried on which leads to a conversion of the diseased portion into a species of fibro-cartilage. The induration may, after lasting a considerable time, pass into suppuration. It either affects a considerable portion of the brain in depth, or extends superficially over the surface; or there are several small circumscribed indurated spots.

A curious case is related by Baader of a man aged 40, who became suddenly epileptic, with fixed local pain on the left side of the head, and such exquisite sensibility of the surface of the left hand and arm, that the slightest breath of cold air upon them brought on convulsions. He died rather suddenly, after an illness of five years. There was a superficial induration of the brain corresponding to the seat of the pain, and under the indurated part there was an abscess of the size of an egg.

Organic Diseases.—It is the opinion of several writers, among whom is Dr. Abercrombie, that the state of simple induration of the brain just described, may be considered as the origin or first stage of the organic tumours sometimes found in the brain; that these tumours are the result of chronic inflammation; and that the various forms of scrofula, carcinoma, melanosis, fibro-cartilage, or hydatids, which they assume, depend on peculiarities of constitution or other accidental circumstances with which we are unacquainted.

Dr. Abercrombie mentions that in some cases the portion of indurated brain has been found surrounded by a cyst, so as to form a complete tumour. He thinks it probable that this is only a part of the cerebral substance in a state of low scrofulous inflammation; that in its early stage it is a disease which may be cured; and that the formation around it of a cyst by the deposition of coagulable lymph, or its termination by an induration of the part, are the points in its progress which give it the character of organic or hopeless disease. Accordingly, this might be considered as the intermediate step between chronic inflammation and the development of organic disease. This is an ingenious view of the subject; but it does not rest upon sufficient evidence to be received yet as an established truth: the whole question involving the origin and nature of organic tumours, and also of tubercles, is one of considerable interest and importance, and respecting which there exists much diversity of opinion.

The principal organic diseases are, bony tumours of the internal surface of the cranium; thickening or excrescences of the dura mater; a variety of tumours in the brain, some consisting chiefly of a whitish mass, having the properties of albumen; others more organised, reddish, and resembling the substance of the kidney; others carcinomatous, fatty, or tubercular: the latter are by far the most frequent, particularly in children. Ossification and long spiculæ in the dura mater, falx, or tentorium, and serous cysts and hydatids are also sometimes found. There are others of more rare occurrence, such as stony and bloody tumours, fungus hæmatodes, melanosis, fungous excrescences of the brain or of its membranes, protruding sometimes through the cranium. There are several instances of a clot of blood becoming organised and forming a tumour. It is next to impossible to distinguish these organic diseases from each other during life. When there is any well-marked specific diathesis, such as the scrofulous or the cancerous, some plausible conjecture may perhaps be formed respecting their nature. In a few of the recorded cases of cancer in the brain, there were severe lancinating pains through the head; but this is not a point of much consequence, as they are hopeless diseases.

The existence of organic disease in the brain is manifested by various lesions of the intelligence, voluntary motion, and sensation: the effects either of pressure on the brain or of inflammation. These diseases bear, therefore, a strong resemblance in their symptoms to some of the forms of cerebritis. Acute cerebritis is not very likely to be mistaken for organic disease, as the symptoms of the former run their course with a degree of rapidity and violence which never belongs to the latter. The diagnosis, however, between the more chronic forms of cerebritis and organic disease may sometimes be attended with greater difficulty; and it is necessary to pay great attention to the mode of invasion, progress, and duration of the symptoms in each class of diseases, in order to distinguish them from each other. The progress of the symptoms in organic diseases is very slow, irregular, and intermittent; very trivial circumstances are sometimes sufficient to bring on attacks of cephalalgia, vertigo, temporary apoplexy, or convulsion; such as quick exercise, hot rooms, sudden emotions, prolonged attention in reading or writing, a low position of the head; in fact, every thing calculated to disturb and hurry the circulation in the brain. When this organ is already suffering from pressure, a very slight change in its circulation may suffice to give rise to the most alarming symptoms; but these subside as soon as the momentary congestion is removed, and the patient then recovers every appearance of his usual health. In some cases the symptoms entirely disappear for a considerable time, and then return with increased violence. The disease does not in general assume a decidedly active and regular character until the surrounding brain becomes inflamed; and the two forms of disease being then combined, the ordinary symptoms of cerebritis make their appearance.[*] In chronic cerebritis, although in some instances the symptoms may be slow and irregular, they do not in general exhibit such sudden exacerbations or complete and protracted intermissions, nor are they aggravated by the same trivial cause. Cases, however, attended with much doubt and difficulty, may sometimes present themselves, especially when chronic cerebritis terminates in induration; but it may be laid down as a general rule, which will materially assist in forming the diagnosis, that the very large majority of cases of primary cerebritis run their course in less than six months from the time of the full development of the disease; whilst the great majority of organic diseases last beyond that time, and some even as long as several years. The tubercular diseases are those the course of which is most rapid, particularly when there is active tubercular inflammation in other parts of the body.

Hypertrophy.—Several pathologists, and amongst others Laennec and Jadelot, have described an alteration of the brain connected with its acute diseases, which they term *hypertrophy:* this alteration appears to have been known also to Morgagni. Laennec observed it in persons who had previously been supposed to be affected with hydrocephalus internus; also in epileptic children, and in others who had died of convulsions. The following are its distinctive characters:—the convolutions of the brain are crowded together and flattened; the intervals between them disappear; and it seems as if the membranes of the brain were too tight for it. After the upper part of the cranium has been removed, it is found difficult to make it fit on again, the brain appearing too large for the cavity of the skull; the substance of the organ is firm, contains but little blood, and appears remarkably dry when cut into; the ventricles are, as it were, effaced, and the various surfaces of the brain deprived of their ordinary moisture: in other respects the texture remains unaltered. The affection is most frequently general. Andral has however seen a case, in which the left thalamus was one-fourth larger than the right, which was of the natural size; there had not been any particular symptom observed during life, that could lead to a suspicion of such a state of the parts. No instance of hypertrophy of the cerebellum has hitherto been published. In a few rare cases the enlargement of the brain has been carried to such an extent as to occasion an enlargement of the skull. A remarkable case is recorded in the *Archives de Médicine*, 7th volume, of a child of five years of age, who had a head as large as that of a stout man; the parietes of the cranium varied from a line and a half to two lines in thickness; it was chiefly the hemispheres that were enlarged; there had not been any peculiarity in the intellectual faculties;—the death was owing to another accidental cause. The brain appears sometimes as if generally enlarged, when its vessels are overdistended with blood, in inflammatory fever, &c. This state must not be mistaken for the hypertrophy just described. [See Condie, *Practical Treatment on the Diseases of Children*, p. 336: Philad. 1844.]

We shall briefly notice another class of morbid alterations of the brain, as being connected with its acute affections; we mean those observed in lunatics. After acute mania, the cortical substance on the whole surface of both hemispheres has been found deeply injected, and of an intense red, similar to that of erysipelas. In other cases of longer standing the membranes had contracted close adhesions to the brain; the cortical substance was red and so much softened, that the membranes could not be removed without tearing it away with them; it had also a granulated appearance. In very old cases the convulsions have been found remarkably diminished in size; and this has seemed to arise from the atrophy of the cortical substance, which was reduced to a very thin layer, and of a pale dirty colour; there has been generally in such cases a serous effusion, as if to fill up the vacuum. The medullary sub-exhaustion on the fifteenth day. Inflammation and softening are not, however, so frequently observed in the cerebellum as in other parts of the brain. The diagnostic symptoms are in general very obscure; the intellectual faculties are generally less affected than when the disease is situated in the cerebrum.

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[*] The late Dr. Wollaston died of an organic disease of the brain, which there is good reason to suppose originated in slow chronic inflammation: we find it stated, in the post-mortem examination, that the optic thalamus of the right side was found converted into a tumour as large as a middle-sized hen's egg; towards the circumference, it was of a greyish colour, harder than the brain, and somewhat of a caseous consistence, but in the centre, of a brown colour, soft, and in a half-dissolved state. We learn from Dr. James Somerville, who attended him, that he had suffered more or less for several years from a train of symptoms corresponding to those above described, and that he ultimately died paralytic. Four years previous to his death (in 1828) he read before the Royal Society an ingenious paper on a peculiar defect of vision to which he was subject, and which, it is highly probable, was a symptom of the incipient disease of the brain.

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The existence of organic disease in the brain is manifested by various lesions of the intelligence, voluntary motion, and sensation: the effects either of pressure on the brain or of inflammation. These diseases bear, therefore, a strong resemblance in their symptoms to some of the forms of cerebritis. Acute cerebritis is not very likely to be mistaken for organic disease, as the symptoms of the former run their course with a degree of rapidity and violence which never belongs to the latter. The diagnosis, however, between the more chronic forms of cerebritis and organic disease may sometimes be attended with greater difficulty; and it is necessary to pay great attention to the mode of invasion, progress, and duration of the symptoms in each class of diseases, in order to distinguish them from each other. The progress of the symptoms in organic diseases is very slow, irregular, and intermittent; very trivial circumstances are sometimes sufficient to bring on attacks of cephalalgia, vertigo, temporary apoplexy, or convulsion; such as quick exercise, hot rooms, sudden emotions, prolonged attention in reading or writing, a low position of the head; in fact, every thing calculated to disturb and hurry the circulation in the brain. When this organ is already suffering from pressure, a very slight change in its circulation may suffice to give rise to the most alarming symptoms; but these subside as soon as the momentary congestion is removed, and the patient then recovers every appearance of his usual health. In some cases the symptoms entirely disappear for a considerable time, and then return with increased violence. The disease does not in general assume a decidedly active and regular character until the surrounding brain becomes inflamed; and the two forms of disease being then combined, the ordinary symptoms of cerebritis make their appearance.* In chronic cerebritis, although in some instances the symptoms may be slow and irregular, they do not in general exhibit such sudden exacerbations or complete and protracted intermissions, nor are they aggravated by the same trivial cause. Cases, however, attended with much doubt and difficulty, may sometimes present themselves, especially when chronic cerebritis terminates in induration; but it may be laid down as a general rule, which will materially assist in forming the diagnosis, that the very large majority of cases of primary cerebritis run their course in less than six months from the time of the full development of the disease; whilst the great majority of organic diseases last beyond that time, and some even as long as several years. The tubercular diseases are those the course of which is most rapid, particularly when there is active tubercular inflammation in other parts of the body.

Hypertrophy. — Several pathologists, and amongst others Laennec and Jadelot, have described an alteration of the brain connected with its acute diseases, which they term *hypertrophy*: this alteration appears to have been known also to Morgagni. Laennec observed it in persons who had previously been supposed to be affected with hydrocephalus internus; also in epileptic children, and in others who had died of convulsions. The following are its distinctive characters:—the convolutions of the brain are crowded together and flattened; the intervals between them disappear; and it seems as if the membranes of the brain were too tight for it. After the upper part of the cranium has been removed, it is found difficult to make it fit on again, the brain appearing too large for the cavity of the skull; the substance of the organ is firm, contains but little blood, and appears remarkably dry when cut into; the ventricles are, as it were, effaced, and the various surfaces of the brain deprived of their ordinary moisture: in other respects the texture remains unaltered. The affection is most frequently general. Andral has however seen a case, in which the left thalamus was one-fourth larger than the right, which was of the natural size; there had not been any particular symptom observed during life, that could lead to a suspicion of such a state of the parts. No instance of hypertrophy of the cerebellum has hitherto been published. In a few rare cases the enlargement of the brain has been carried to such an extent as to occasion an enlargement of the skull. A remarkable case is recorded in the *Archives de Médicine*, 7th volume, of a child of five years of age, who had a head as large as that of a stout man; the parietes of the cranium varied from a line and a half to two lines in thickness; it was chiefly the hemispheres that were enlarged; there had not been any peculiarity in the intellectual faculties;—the death was owing to another accidental cause. The brain appears sometimes as if generally enlarged, when its vessels are overdistended with blood, in inflammatory fever, &c. This state must not be mistaken for the hypertrophy just described. [See Condie, *Practical Treatment on the Diseases of Children*, p, 336: Philad. 1844.]

We shall briefly notice another class of morbid alterations of the brain, as being connected with its acute affections; we mean those observed in lunatics. After acute mania, the cortical substance on the whole surface of both hemispheres has been found deeply injected, and of an intense red, similar to that of erysipelas. In other cases of longer standing the membranes had contracted close adhesions to the brain; the cortical substance was red and so much softened, that the membranes could not be removed without tearing it away with them; it had also a granulated appearance. In very old cases the convulsions have been found remarkably diminished in size; and this has seemed to arise from the atrophy of the cortical substance, which was reduced to a very thin layer, and of a pale dirty colour; there has been generally in such cases a serous effusion, as if to fill up the vacuum. The medullary sub-with inflammation at the junction of the posterior and middle lobes. When several parts are paralyzed at the same time, the morbid alterations of the brain are supposed to be more extensive, or seated near the medulla oblongata. Paralysis of the arm and leg on the same side, or hemiplegia, is supposed to follow the combined affection of the corpus striatum and thalamus, or else disease of the crus cerebri, from which these two bodies derive their origin.

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* The late Dr. Wollaston died of an organic disease of the brain, which there is good reason to suppose originated in slow chronic inflammation: we find it stated, in the post-mortem examination, that the optic thalamus of the right side was found converted into a tumour as large as a middle-sized hen's egg; towards the circumference, it was of a greyish colour, harder than the brain, and somewhat of a caseous consistence, but in the centre, of a brown colour, soft, and in a half-dissolved state. We learn from Dr. James Somerville, who attended him, that he had suffered more or less for several years from a train of symptoms corresponding to those above described, and that he ultimately died paralytic. Four years previous to his death (in 1828) he read before the Royal Society an ingenious paper on a peculiar defect of vision to which he was subject, and which, it is highly probable, was a symptom of the incipient disease of the brain.

The last speculation on this subject which we shall refer to, is one relating to the respective uses of the cortical and medullary substances of the brain. We have seen that the cortical substance has been found, in a great many lunatics, highly injected, and often inflamed, whilst the medullary substance remained healthy. M. Foville and Pinel Grandchamp have conjectured from this and some other circumstances, that the cortical substance was the seat of intelligence, whilst the medullary was intended to preside over motion. The principal other grounds of this hypothesis are, the apparent decrease of the cortical substance, which has been found reduced to a very thin layer, in cases of imbecility; the small size of the convolutions and small quantity of cortical substance observed in the brains of idiots, compared with those of intelligent beings.

In the article *Encéphale*, of the volume of the *Dictionnaire de Médecine et de Chirurgie Pratique*, just published, M. Foville, whose recent discoveries on some points of the minute anatomy of the brain have deservedly attracted much attention, enters at considerable length into the examination of the preceding considerations. He has adduced a number of striking facts and arguments in their support, and lays down the following general propositions:

1. The joint lesion of the corpus striatum and thalamus of one side gives rise to the same paralytic symptoms as the lesion of the whole fibrous substance of the corresponding hemisphere, of which they are in some manner the centres or nuclei.

2. The lesion of the crus cerebri is followed by the same paralytic symptoms as that of the corpus striatum and thalamus, which are themselves in a great measure formed by the expansion of the fibres of the crus.

3. A lesion of the medulla oblongata produces all the symptoms which arise from the joint affection of the crura cerebri and cerebelli; and if we ascend still higher in the brain, from that also of the corpora striata, thalami, and hemispheres.

4. If we direct our attention to the portion of the nervous system below this great centre of the nervous action of the brain, we shall find the cerebral influence continue unimpaired in all parts superior to any lesion of the spinal marrow, whilst it is completely intercepted in parts inferior to that lesion.

Prognosis.—Cerebritis is a disease always attended with considerable danger. When once fully developed, it has hitherto been generally considered as incurable; but since we have been enabled, by a better knowledge of its true nature, to apply with promptitude more appropriate remedies, the treatment is often successful, even under the most unpromising circumstances. The extremely delicate structure, however, of the brain, its situation in a bony unyielding case, without room for expansion, or any opening for the exit of effused fluids, and the great importance of the integrity of its functions to the preservation of life, are circumstances which must always connect a considerable degree of danger with its inflammatory affections.

It may be said in general, that so long as the inflammation is only in the first stage, and the texture of the brain not broken down by the infiltration of blood, pus, or serum, resolution is still possible. The following circumstances may lead us to hope for this favourable termination: the paralysis being only partial; the muscles firm, not flaccid, and retaining some degree of motion; the sensibility being little impaired; after an attack of coma, a gradual return to consciousness, without affection of the intellect; sound sleep; the tongue cleaning, and motion progressively returning in the paralyzed parts. It must not be forgotten, however, that there are frequently exacerbations and remissions in the symptoms; intervals of apparent recovery and a great tendency to relapse. It has been already stated that a delusive amendment often attends the passage of the inflammation from the first stage into that of softening or suppuration. Such an amendment, therefore, at a late period, is more to be suspected than in any earlier stage of the disease. The continuance of headach, uneasy sleep, shiverings, and languor are unfavourable symptoms, whatever may have been the amelioration in other respects. Headach and delirium are less unfavourable than stupor and coma. When profound coma is succeeded by headach and delirium, this is rather a favourable occurrence, as it indicates a return of the previously paralysed action of the brain; when, on the contrary, they are followed by coma, it is a bad omen. The danger is of course in proportion to the extent of the paralysis, and greater in complete hemiplegia than when the paralysis is confined to one limb. When the paralysis extends to the side of the body which was at first free, the danger is imminent, since both hemispheres are then affected; and when both sides are simultaneously paralysed, a speedily fatal termination may be predicted. Embarrassed breathing is always a bad symptom.

When the inflammation has reached the second stage, and the diseased portion of brain has become softened and infiltrated with pus, the danger is great and the recovery very doubtful. Paralysis of the bladder and retention of urine are generally fatal symptoms.

The chronic form of cerebritis, accompanied by very slow and creeping palsy, is always an unpromising disease. The circumstance of the symptoms at first being slight, and confined to an apparently trifling numbness or weakness in a few muscles, must not throw the practitioner off his guard. This form of disease is almost always attended with a considerable degree of failure of the powers of the constitution; and sooner or later, in the majority of cases, comes to an unfavourable termination. The more acute cases afford a better prospect of recovery, there being sufficient strength to admit of the use of active remedies.

The coma and paralysis following a sudden attack of sanguineous apoplexy are attended with less danger than the coma and complete paralysis of the latter stage of cerebritis; for there are numerous instances of the resorption of a clot of blood, whilst those of the resorption of pus and healing of an abscess are extremely rare. The inflammation of the brain consecutive to sanguineous apoplexy is always dangerous, and greatly lessens the chances of recovery. Cerebritis following concussion is generally severe, and attended with greater danger than that consequent upon an injury of the head with opening in the skull.

The duration of cerebritis varies according to its form. Acute cerebritis generally runs a rapid course; it may prove fatal the first, second, or third day, and seldom lasts more than from ten to twelve days. Chronic cerebritis is very variable in its duration, being often attended with intermissions and relapses; the disease may thus be prolonged for several months, and some cases have been described as lasting even several years; but it is more than probable that when symptoms resembling those of cerebritis continue beyond five or six months, they do not arise from genuine cerebral inflammation, but are to be attributed either to an organic tumour, or to some neuralgic affection simulating chronic cerebritis. In a collection of thirty-four cases, nine died in the course of the first week, six in the second, six in the third, two in the fourth, and eight in the course of from two to six months.

With respect to age, it appears that old age and childhood are the two periods of life the most exposed to cerebral inflammation. The examination of a large number of cases shows that more than two-thirds were persons above forty-five, and a majority of these between forty-five and seventy. It is a disease, however, which may affect all ages. The frequency of falls and blows on the head in children, the irritation of dentition, the pressure of the head during parturition, predispose them to cerebritis, although there is perhaps a greater tendency at that period of life to membranous inflammation. Traces of cerebritis have been found in still-born children. Men are more subject to cerebritis than women, in the proportion of about two-thirds, owing probably to their being more exposed to the influence of exciting causes. The disease, also, is more common in hot than cold climates, and in summer than winter.

Causes.—The causes are predisposing and exciting. The only difference, however, between these often consists in their degree of activity; since a predisposing cause may become exciting if its activity be sufficiently increased. Every circumstance capable of causing congestion, or of disturbing the balance between the arterial and venous circulation in the brain, becomes a predisposing cause. These circumstances are a plethoric habit, particularly in individuals who have short necks and are subject to habitual constipation, the diathesis justly termed apoplectic. Persons, however, of a thin habit and slender make, with long neck and pallid countenance, and especially if such individuals are intelligent, are also under certain circumstances predisposed to cerebral affections, particularly when labouring under disease of the heart. An hereditary tendency to fulness in the head and diseases of the brain may be reckoned among the predisposing causes. Hypertrophy of the heart, particularly of the left ventricle, is a very common predisposing and sometimes exciting cause. The celebrated Malpighi died of an inflammatory affection of the brain, attributed to hypertrophy of the heart, from which he had long suffered. Disease of the heart acts either by impeding the regular return of the blood from the head, or causing the blood to be propelled with excessive impetus towards the brain; the latter takes place more particularly when the hypertrophy is produced by obstruction in the aorta beyond the origin of the carotid arteries. Inflammation of the lungs, phthisis, and asthma act in the same manner in producing cerebritis, though these diseases are less powerful exciting causes than those of the heart. There is a great predisposition in phthisis to sudden attacks of inflammation of the brain or its membranes; the patient is all at once seized with intense headach and violent delirium, ending sometimes in confirmed mania, and it is very remarkable that the pulmonic symptoms, howsoever severe, have often in such cases suddenly disappeared, and have not returned until the attack in the head had subsided, the two affections thus alternating the one with the other. It cannot be said in every case that the cough and other pectoral symptoms are merely obscured, for we have seen cases of perfect recovery from an advanced stage of phthisis, by the supervention of an attack of mania. These are striking examples of the actual translation of disease. Dr. Abercrombie very justly observes that there may be in scrofulous constitutions a tendency to scrofulous inflammation of the brain, and that the disease of the lungs is not properly to be always considered as the cause of the head affection; that in the same manner disease in the brain may appear in connexion with the disease of any other organ, and that diseased liver has often been thus improperly stated to be the cause of hydrocephalus.

The mutual influence of the functions of the brain and digestive organs on each other is so obvious as not to require any explanation; and thus the headach, drowsiness, and other signs of cerebral congestion, which follow over-distension of the stomach, or the abuse of spirituous liquors, are easily accounted for. Habitual drunkenness is perhaps one of the most powerful causes of cerebritis or arachnitis. The striking similarity between the symptoms of the last stage of intoxication and those of apoplectic coma has been frequently noticed. The subacute inflammation of the mucous membrane of the stomach and bowels, the gastro-enterite of Broussais, is often accompanied by great cerebral irritation. This complaint, in young children from two to four years old, frequently terminates in coma. A vitiated state of the secretions of the alimentary canal is a very active and frequent cause of cerebral irritation; it accompanies that fretfulness and irritability of temper which so commonly precede attacks of inflammation in the brain. the convulsions produced by intestinal worms are also the effect of sympathetic irritation.

There is a disease of the urinary organs, known as ischuria renalis, of rather uncommon occurrence, which predisposes sometimes to dangerous affections of the brain. Sir Henry Halford has published an interesting paper on this subject. (Transactions of the College of Physicians, vol. vi. p. 398.) In many of the cases, after the patient has suffered for two or three days from dull pain and sense of weight in the iliac regions, these symptoms are succeeded by great anxiety, nausea, vomiting, hiccup, cramps, slow pulse, delirium; and he gradually falls into a state of lethargy and coma. The ventricles of the brain are found on dissection distended with serum.

The suppression of urine is sometimes not complete; if there be perspiration, it may have a urinous smell. Suppression of urine is sometimes not attended with any marked inconvenience. Dr. Parr, in his dictionary, mentions the case of a person who had suppression of urine for six weeks and yet recovered. Dr. Abercrombie gives a case in which the suppression was occasioned by obstruction of both ureters; the patient died on the thirteenth day, of a cerebral affection.

Ischuria renalis has in some instances been supposed to originate in a disease of the brain, causing paralysis of the kidneys. The persons most subject to this affection are fat corpulent men, between fifty and sixty years of age, of a gouty habit, and naturally predisposed to cerebral congestion, though it is sometimes also met with in children.

We have already said that inflammation of the brain may occur in the course of a variety of febrile diseases, such as continued fever, scarlatina, measles, &c. It has often been observed as one of the sequelæ of scarlatina; and when accompanied with anasarca, its inflammatory character has been entirely overlooked, and attributed to mere serous effusion in the brain. There is a great tendency to cerebral congestion in the continued fevers of this country; thus of eight hundred and sixty-four cases treated in a large fever hospital, six hundred and two presented head symptoms. Suppuration of the brain may sometimes occur in the course of fever, but it is not very common; of fifty cases of fever with well-marked cerebral symptoms, pus and blood occurred in only three. Subacute inflammation of the membranes is of much more frequent occurrence. The injury, however, sustained by this organ during an attack of fever with violent head symptoms, often gives a predisposition to future cerebral inflammation.

Among the predisposing causes are to be ranged suppressed evacuations. That of the catamenia, especially in young women, is often followed by dangerous affections of the brain. A similar result may attend the suppression of artificial discharges and of cutaneous eruptions, the healing of chronic ulcers, erysipelas, gouty or rheumatic affections of the joints, &c. Over-exertion of mind, depressing passions, such as grief, fear, &c. great bodily fatigue, long-continued nervous headachs, and all neuralgic affections of the brain, epilepsy, and mania, operate as predisposing and sometimes exciting causes. The brain cannot long suffer from nervous irritation without a re-action taking place in its vascular system.

External injuries are among the most direct exciting causes; and this is much more frequently the case than is imagined, particularly in children. A considerable interval, sometimes two or three weeks, may intervene between the injury and the appearance of alarming symptoms; and a very trifling fall or blow, which is often the cause of serious disease, may have been altogether overlooked or forgotten.

Exposure to the intense heat of the sun is a powerful exciting cause. It may bring on either arachnitis, cerebritis, apoplexy, or mania. The same results may follow a sudden transition from heat to cold. Long exposure to intense cold acts also in a remarkable manner on the brain, bringing on inflammation, and sometimes the most violent maniacal delirium: there were many remarkable examples of this during Napoleon's campaign in Russia.

Inflammation and suppuration of the internal ear has a great tendency to extend to the brain, and it is in this manner it often proves fatal. Tedious and painful dentition is a great source of cerebral irritation; intense and long-continued pain from any cause often brings on delirium and coma. The ligature of large branches of nerves in the neighbourhood of the head has had this effect; of which the following case, related by Lallemand, is a remarkable instance. The subclavian artery was tied above the clavicle for an aneurism in the axilla on the *right* side; several branches of the brachial plexus, supplied by the third cervical, were included in the ligature; intense pain was immediately felt in the neck; this went on increasing, notwithstanding the most active treatment; coma, convulsions, and a strong retraction of the head appeared the seventh day; the patient died on the eighth. The posterior portion of the *left* hemisphere of the brain presented a large undefined abscess, containing softened diffluent brain, and in the centre greenish pus; the sides of the abscess were deeply injected; the arachnoid was healthy. Such a case is interesting both to the pathologist and physiologist.

The internal use of certain narcotic and irritating poisons may become a cause of cerebral inflammation. This is the special property of nux vomica; and we have seen its unguarded administration in hemiplegia bring on a fresh attack of inflammation of the brain. The inhalation of putrid effluvia and contagious miasmata, particularly in very hot climates, and when the system is in a state of depression, has been quickly followed by cerebral inflammation. We had experience of this ourselves some years ago, while attending a fever hospital. After inhaling a horrid fœtor which emanated from a patient in an advanced stage of typhus gravior, we were instantly seized with sickness and headach, as if struck by a blow, and, in less than forty-eight hours after, a dangerous attack of typhus fever supervened, attended by strong cerebral symptoms. The action of these numerous causes is very variable; sometimes sudden and rapid, at others slow and imperceptible.

Treatment.—The inflammatory nature of the more acute forms of cerebritis and arachnitis is so obvious, that their treatment has always been conducted on correct principles. Until very lately, however, the inflammatory character of partial and chronic cerebritis was either entirely overlooked, or so imperfectly understood, that though active treatment was sometimes adopted at the beginning of the disease, it was soon laid aside, and remedies of an opposite description substituted. These affections were in fact generally set down as nervous; mistaken for rheumatism, neuralgia, nervous dyspepsia, and debility, or nervous palsy, and treated by tonics, electricity, and stimulants; the fatal termination of the disease being thus accelerated.

Cerebritis and arachnitis are so formidable, that their prevention is of no less, if not of greater importance, than their treatment. It is extremely important to have recourse to active measures on the very first appearance of any of the premonitory symptoms, however trifling: as we may thus succeed in effectually removing that state of congestion and irritation of the brain, which is the precursor of inflammation. The means of accomplishing this are, the careful and timely removal of all the exciting causes; of every source of irritation, both bodily and mental; regulation of the diet; avoiding all excesses; relaxation from study, change of air, general and local bloodletting, counter-irritation, with occasional purgatives. Great vigilance is particularly required in the cerebral affections of infants and children, who frequently suffer without complaining. A predisposition to affection of the brain may often be suspected by some slight cast or rolling of the eyes; by dilatation of the pupils; or occasional startings, and attacks of spasmodic croupy breathing during sleep: there may be every other appearance of perfect health with these symptoms, which are often only evanescent; but they will not escape the attention of the experienced observer, and will be sufficient to put him on his guard.

When it is necessary to relieve the brain from habitual congestion by occasional topical bleeding, the method of taking blood from parts as remote from the disease as possible, seems to us preferable to that of abstracting blood from the head itself. When the vessels of a part are partially emptied of their blood, if they have been much weakened by long-continued over-distension or previous disease, so as to have lost their elasticity, there will be an immediate flow of fresh blood to the part; this will take place on mere hydrostatic principles. We have thus seen in an eye long exposed to injection and low inflammation, the redness and suffusion much greater the day after an application of leeches than it was before; and we have likewise known headach considerably increased in plethoric and bloated people, after leeches had been applied to the temples. On the other hand, no fact is better established than that the loss of an exceedingly small quantity of blood from certain parts of the body is sufficient to relieve distressing symptoms of congestion and oppression in others most remote from them; as, for instance, a very slight discharge of blood (one or two ounces) from the hemorrhoidal veins being sufficient instantly to remove vertigo, flushing, headach, or oppressed breathing: the same is the case in a still more striking manner with the catamenia, although some account must be taken of the influence of uterine irritation over the system. We prefer, therefore, in cases of habitual congestion in the brain, taking blood occasionally from the feet or legs, by opening a vein, or applying leeches and letting them bleed in a foot-bath; or the application of leeches to the anus, whenever practicable. We have found this the surest method of affording permanent relief; and by repeating it at certain intervals, the tendency to cerebral congestion may be completely overcome. We have pursued this plan in lunatics with the very best results. It was a practice of the ancients, which has, in our opinion, been too much laid aside. When, however, there is active inflammation in a part, as it is most material to unload the vessels freely and quickly, the blood had better, in such a case, be drawn from the immediate neighbourhood of the organ affected.

The insertion of an issue is often advisable, as a preventive, in people of a plethoric habit. The head should be kept cool by the frequent use of cold ablutions; the hair cut short; the head and shoulders raised at night; tight bandages round the neck must be avoided; the daily use of the cold shower-bath is often very beneficial; but a re-action takes place in the head unless it be used with the feet immersed in hot water. The feet, legs, and lower parts of the body ought to be carefully kept warm and dry.

In the treatment of cerebritis, when fully developed, attention must be paid to its two periods of *excitement* and *collapse*. The remedies chiefly to be relied upon are, bloodletting general and topical, purgatives, cold applications to the head, and counter-irritation.

In the more acute cases the patient must be freely bled from a large orifice to the amount of from twenty to forty ounces: one copious bleeding has more effect in bringing about the speedy resolution of the inflammation than several small bleedings. If the symptoms continue unabated, the bleeding must, however, be repeated several times, at intervals of a few hours; and this practice must be carried, during the first period of the disease, to the utmost limit of the patient's strength. It often happens that very little impression is made on the disease by the first bleeding, and no amendment takes place until after the second. The symptoms often abate after bleeding; but a fresh exacerbation may take place in the course of a few hours. Topical bleeding, by cupping or leeches, is, under such circumstances, highly beneficial.

The head must be shaved, and pounded ice mixed with cold water and vinegar may be applied to the scalp. A very effectual method of applying cold is by making the patient hold his head over a basin, and pouring a stream of cold water on it from a certain height: this often removes the heat and flushing, and calms the excitement: it should be repeated as often as the heat and flushing return. The application of cold to the body is always followed by a re-action, and the temporary relief refrigerants afford will be succeeded by an increase of the inflammatory symptoms, and their use become decidedly injurious unless their depressing action be kept up by a steady and repeated application. Some practitioners have, on this account, given the preference to the use of a mixture of alcohol or ether with liquor ammoniæ acetatis and water, applied not quite cold, in order to produce rapid evaporation.

An excellent practice is that of keeping the patient's feet and legs immersed in hot water during the application of cold to the head.

The remedies next to bleeding and cold, and often not less efficacious, are active purgatives, which must be administered at short intervals until copious evacuations be procured. Free purging sometimes makes a greater impression on the disease than even bleeding. In some cases no marked amendment has taken place until the bowels have been freely moved: they are sometimes exceedingly torpid, for reasons which have been already assigned, and large doses of cathartics may be required. Combinations of calomel, jalap, scammony, and cathartic extract, followed by an infusion of senna with salts, are the purgatives on which the most reliance can be placed. Croton oil is also in these cases a valuable remedy, from the facility of its administration and certainty of its effects. Mercury may be given freely as a purgative, but no particular advantage has appeared to follow its use with a view to affect the constitution; it is, indeed, found very difficult in acute diseases to produce ptyalism.

We have sometimes found tartar emetic of great service when there was no irritability of stomach to prevent its being tolerated; the power of tartar emetic in controlling the action of the heart, and subduing the inflammatory diathesis, is now fully established: a solution in the proportion of one grain to the ounce, and two table-spoonsful given every two, three, or four hours, suspending it should vomiting occur, has often been attended with great benefit. The remedy is in general well tolerated, owing to the torpor of the stomach: violent vomiting should, however, be prevented, as it would obviously be extremely injurious.

In the second stage of acute cerebritis, that of collapse and coma, general bloodletting is to be used more sparingly; decided advantage, however. has resulted from a moderate bleeding even at a late period. In this stage, topical bleeding is more generally indicated. There are periods of exacerbation in the symptoms which should be watched and overcome by these means; which may be persevered in as long as there is any hardness and resistance in the pulse. We have seen a patient instantly recover from a state of profound coma by the abstraction of a very small quantity of blood with the cupping-glass. When bleeding is no longer adviseable, moderate purging may still be of use. In this stage, we may have recourse to counter-irritation with advantage: blisters may be applied between the shoulders, to the occiput, or to the neck or legs. There is an objection to their being applied to the whole head, that it prevents the subsequent application of cold. We have, however, in desperate cases, seen a decided amendment follow the application of a large cap blister. Particular attention should be paid to the abdominal region, and especially that of the bladder, which ought to be examined morning and evening, in order to detect retention of urine; and we must take care not to be led into error by an incontinence of urine from the over-distension of the bladder: this must be obviated by drawing off the urine with the catheter twice a day.

In the more chronic forms of cerebritis, unattended with fever or much general excitement, the same activity of treatment is of course not admissible. We must still, however, pursue the antiphlogistic plan, modifying it according to the urgency of the symptoms. During the period of irritation, with cephalalgia, vertigo, or rigid spasm of the extremities, moderate bleeding, general and topical, purgatives and counter-irritation, are the only remedies from which any advantage is to be expected: they must be repeated at longer or shorter intervals, according as the strength of the patient and the continuance of the symptoms may seem to indicate. A great deal is to be accomplished in all chronic inflammations by persevering in a moderate course of antiphlogistic treatment. We must watch carefully any signs of amendment, remembering that there is a great tendency to relapse, and that the natural course of the complaint is characterised by irregular remissions and exacerbations.

When the period of irritation is over, and is followed by a remission of all signs of excitement, by a complete paralysis of the muscles, and by the other evident signs belonging to the period of softening and suppuration, the strength of the patient must no longer be reduced by active treatment. In all inflammatory diseases, when the stage of excitement and disorganization is over, a process of reparation commences, which requires for its completion a certain degree of power in the constitution. If at this period we persevere in lowering the general strength, we deprive the constitution of its natural resources, and interfere with its healing operations. It becomes, therefore, an object of considerable importance to watch the moment when the tide of excitement is on the turn, and when the powers of the constitution are verging to a state of collapse, in order that we may abstain from an injurious interference, husband the patient's strength, and even support it if required. This precaution is particularly necessary in old people and young children. We think it necessary to lay some stress on this rule of practice, as there is perhaps a tendency in the present day to overlook it; and we have seen considerable harm from carrying the antiphlogistic treatment beyond its safe limitation. We have already alluded to the pseudo-symptoms of cerebral congestion and inflammation which are sometimes the consequence, especially in children, of extreme exhaustion, and require the use of cordials.

After convalescence has been established, the patient will still require to be closely watched for some time, before his recovery can be considered fully confirmed: he must be kept perfectly quiet, free from every species of excitement, and the regimen duly regulated. When the brain has once suffered from inflammation, it is slow in recovering its tone, and the most trifling cause, such as a slight mental exertion or emotion, a full meal, &c., has been, in many cases, sufficient to occasion a relapse.

When cerebritis has occurred after suppressed evacuations or the metastasis of other diseases, we should endeavour to procure their return. If menstruation be suppressed, leeches should be applied to the pubis or inguinal regions, and the frequent use of hot pediluvia with flour of mustard recommended. If cutaneous eruptions or rheumatic gouty pains in the joints previously existed, blisters or rubefacients are to be applied to the parts originally affected.

M. Blaud has published in the Bibliothèque Médicale, vol. lxii. several cases in which he says that he speedily overcame the symptoms of cerebritis by the mere compression of both carotids for several seconds; stopping thus the flow of blood to the head. Laennec considered this an unsafe proceeding, and not easy to perform without the risk of suffocation. This plan has often been proposed as a means of checking inflammation, and also of preventing the accession of the paroxysm of ague. We have, however, never seen it tried, and should think its general application scarcely practicable.

The following summary gives a connected view of the various morbid conditions of the brain, which are the effects of congestion and inflammation, together with their symptoms.

1. Cerebral congestion, over-distension of vessels:—vertigo, tinnitus aurium, confusion of sight, cephalalgia; if the pressure on the vessels be carried to a sufficient extent to intercept the circulation,—*simple apoplexy;* seldom fatal; recovery rapid.

2. If the cerebral congestion be permanent, or returns frequently; drowsiness, oppressed intellect; the vessels become weakened, and on a sudden increase of congestion are ruptured; extravasation of blood,—*sanguineous apoplexy:* destruction of cerebral substance and compression; loss of consciousness, permanent or temporary; sudden and complete paralysis, without spasmodic affection of the muscles.

3. General congestion, followed by inflammation of a considerable portion of the brain; deep injection; partial sanguineous infiltration; dotted and ecchymosed striated appearance of the cerebral substance;—*general cerebritis,* (combined usually with arachnitis). Period of high excitement of all the cerebral functions, with general convulsions, followed by a period of collapse and coma.

4. Partial congestion and inflammation of the brain: 1*st period,* the same deep injection and sanguineous infiltration, more circumscribed;—*partial cerebritis.* Partial symptoms of irritation in the organs of motion and sense; weakness, pain, numbness, spasmodic paralysis, confined to one side or a few regions of the body: 2*d period,* infiltration of pus in the cerebral substance; softening, abscess; complete paralysis; relaxation and flaccidity of the muscles; loss of feeling; abolition of some of the external senses or intellectual faculties; death, either gradual or sudden, by the extension of the inflammation, or by pressure.

5. After sanguineous apoplexy and sudden and complete paralysis, inflammation of the cerebral substance surrounding the coagulum; *consecutive cerebritis;* the paralysed limbs affected with pains, convulsive motions, spasmodic rigidity.

6. Slow and gradual congestion, with very slight irritation; long-continued state of low inflammation, ending sometimes in *softening,* sometimes in *induration,* or else in an infiltration of serous fluids and *white softening;*—various forms of *chronic cerebritis;* sense and motion very gradually weakened and impaired, without pains or spasmodic rigidity in the muscles.

Adair Crawford.

[BRIGHT, DISEASE OF. (See Dropsy.)

BRONCHIAL GLANDS, DISEASE OF THE. The bronchial glands, or ganglions, seated around the bronchia, where they dip into the tissue of the lung, are not uncommonly found larger than usual, without there being any evidence of their morbid condition during life; and hence it has been concluded that, when hypertrophied, or otherwise diseased, they seldom produce any striking symptoms. (Stokes, on *Diseases of the Chest,* Amer. edit. p. 266, Philad. 1844.) Thus, in a case recorded by M. Andral, (*Clinique Médicale,* tom i.) where an enormous mass of melanosis compressed the right bronchium, so as to diminish its diameter by one half, there was no stridulous breathing, the signs being a feeble respiration in one lung, with intense puerility in the other. He states, however, that tumours of the bronchial glands frequently cause bronchial and tracheal compression. It need scarcely be said, that if they are so large as to compress the bronchial tubes, they must interfere with breathing; still, the compression may arise so gradually as to account for the very slight effect they induced on the breathing in certain recorded cases. In children, they are frequently enlarged by the deposition of tuberculous matter, and may give occasion to dyspnœa, and to evidences of obstructed circulation. Dr. Stokes (*op. cit.*) affirms that he has never met with an instance of stridulous breathing, or even bronchial compression, produced by their diseased condition; but Dr. Golding Bird has recorded cases in which such compression was witnessed. (See the writer's *Practice of Medicine,* 2d edit. p. 383, Philad. 1844.)

Tumours of the bronchial glands would appear generally to grow forwards, and Dr. C. J. B. Williams (*Lectures on the Physiology and Diseases of the Chest,* &c. Amer. edit. p. 252, Philad. 1839) states, that he has seen them pushing out the sternum or the ribs on one side, and causing dulness of those parts, and symptoms of displacement of the lungs farther down.

When the glands are greatly augmented in children of scrofulous habits, there are no signs that can lead to more than a suspicion that the morbid state exists. The scrofulous diathesis may be accompanied with tuberculosis of the lungs; and, if evidences of compression of the bronchia exist, there may be no signs that can enable us to pronounce positively, that such compression is owing to enlargement of the bronchial glands. These scrofulous enlargements sometimes soften, and are evacuated, by ulceration, into the bronchia. The bronchial glands are also, sometimes, affected by encephaloisis; and it has been suspected by Dr. Williams (*op. cit.*) that encephaloid disease of the lungs generally originates in this way, and spreads afterwards along the vessels into the pulmonary tissues.

Should scrofulosis of the bronchial glands be suspected, the treatment must be such as is proper for the scrofulous cachexy in general.

Robley Dunglison.]

BRONCHI, DILATATION OF. (See Bronchitis, chronic.)

BRONCHITIS. This term is applied to inflammation of the mucous lining of the bronchi or air-passages of the lungs. There are few disorders of more common occurrence; and few, perhaps none, so varied in importance. In its slighter forms it is scarcely deemed an interruption to health; but when severe, it becomes a dangerous and fatal disease. The pathology explains this diversity, and refers the danger, which attends bad cases, to interruption of the due performance of the function of respiration. It does not seem correct, therefore, to describe these different degrees under the different names, *catarrh*, *bronchitis*, *peripneumonia notha*, &c. as some authors have done. The term catarrh implies only the flux or secretion which accompanies the inflammation. We shall therefore include under the present head all affections of the bronchial membrane, which exhibit the characters of inflammation, and reserve the term catarrh for those changes in the secretion of the same membrane that do not appear to originate in inflammation.

Bronchitis presents itself under two forms, the *acute* and the *chronic;* the one differing from the other in the greater intensity of the inflammation, and in the more rapid progress of the disease. We shall therefore consider each form separately, as this method will enable us to point out the circumstances which characterize each variety.

I. Acute Bronchitis.—The commoner cases of acute bronchitis generally succeed to coryza, or inflammatory affection of the mucous membrane lining the nose and its contiguous cavities, the frontal sinuses. Sometimes the inflammation first attacks the tonsils and fauces, from thence is tranferred to the lining of the larynx, and gradually extends downwards to the trachea and bronchi. In other instances the inflammation begins in the bronchi themselves; and this mostly occurs in those whose lungs are susceptible.

The first symptom which characterizes bronchitis is a feeling of roughness in the trachea, which occasions frequent attempts to clear the throat, and is much increased by exertions of the voice, or of the organs of respiration. It soon amounts to such a degree of titillation as to excite cough, which is at first hard and dry. At this time there is generally more or less hoarseness, with a tight feeling across the chest, which often amounts to pain, especially on coughing, and occasions considerable uneasiness in breathing. Some signs of fever are usually felt at this period, such as lassitude, cold shiverings, pain in the limbs, and some acceleration of the pulse. A feeling of chilliness is hardly ever entirely absent, even in the slightest cases. The cough, which at first seems to be caused by an increased sensibility of the inflamed membrane, is very soon accompanied with expectoration of a thin fluid, having a saline taste. This secretion rather increases than otherwise the frequency of the cough; and, like the fluid of coryza, when thin it seems to possess a peculiar irritating quality; for, although the fits of coughing are not so prolonged as they afterwards become, they are more frequent and more irresistible than at any stage of the disease. It is during the continuance of this form of secretion, likewise, that in the common cases of bronchitis, the dyspnœa and pain in the chest first appear; and as the expectoration becomes thicker and more abundant, these are proportionately relieved. It is this change in the character of the cough and expectoration, that in common cases proves the signal for a general amelioration of the symptoms. The constriction of the chest is diminished or removed; the pulse loses its frequency; the skin, which was hot, becomes cooled by free perspiration; the urine, which was scanty and high-coloured, becomes more copious, and deposits an abundant sediment; and the degree and rate of the decline of all the troublesome symptoms very generally correspond with the change of the expectoration. This seems now to have lost its acrid irritating quality, and has less of the saline taste which at first characterized it. In its appearance it changes from a glairy colourless liquid to a pearly tenacious phlegm, increasing in consistence and opacity as it diminishes in quantity, until at length each fit of coughing easily brings up a pellet of opaque white, or greenish white mucus, to which the soot and smoke of the air in large towns often give a grey tinge. This change, or *ripening* of the expectoration, is first observed in the mornings only, and gradually extends, as the disease declines, throughout the day and night. Towards its termination, the cough and expectoration are chiefly observed in the morning and evening.

Such is the ordinary course of the slighter cases of acute bronchitis, for which the nature of their usual cause has obtained the name of "a common cold." But the same disease, differing from these only in the extent of membrane affected, presents a much more formidable character. In such severe cases, rigors and symptoms of general fever usually attend at the onset of the disease. The patient suffers from headach, particularly over the eyes, sickness and loss of appetite, lassitude and great prostration of strength, with occasional pains in the limbs. The tongue is foul, and the urine scanty and high-coloured. The dyspnœa is often urgent from the beginning, particularly in the night; and this symptom, as well as the tightness and pain in the chest, is much aggravated by the fits of coughing. The pain in the chest is most frequently referred to the sternum, and is more obtuse than the pain of pleurisy; it is often accompanied with a sense of weight to which the dyspnœa is ascribed. The pulse is hard and quick, but presents considerable variety as to the degree of frequency and fulness. The matter expectorated is usually scanty at first, and afterwards becomes copious; it is glairy, frothy, sometimes streaked with blood, and its evacuation affords but little relief to the cough or breathing: it has been compared to the white of egg in different degrees of dilution: it is generally most frothy when moderately viscid and in great abundance: its quantity increases, and there is a general aggravation of all the symptoms in the evening. It is at this time that the fever increases, the dyspnœa is most oppressive, and the cough most distressing.

Between the fourth and the eighth days the disease declines in favourable cases; the dyspnœa is diminished, and is confined chiefly to the evening, when there is almost always a tendency to exacerbation. The expectoration now becomes pearly and less abundant, and affords relief to the dyspnœa. The symptoms of fever subside, and the disease either entirely disappears or passes into the chronic form. In certain cases, however, if the therapeutic means have not been seasonably resorted to, or have been insufficient to subdue the acute symptoms of the disease within a few days, a state of collapse very rapidly takes place; the pulse becomes very weak, frequent, and often irregular; the countenance pallid and expressive of great anxiety, and often covered with a cold sweat; the strength is wasted by efforts to relieve the lungs of the accumulating mucus; but the cough becomes less and less effectual to remove it, whilst the wheezing and audible rattle in the large air-tubes increase. Lividity, delirium, and other symptoms of the circulation of black blood in the system, frequently succeed, and the patient dies suffocated. A remarkable feature in the character of the worst form of bronchitis is, the rapidity with which the collapse and symptoms of extreme prostration and debility succeed to high fever and well-marked local excitement; and this circumstance indicates the serious nature of the attack on the vital functions. The whole course of these fatal cases is sometimes wonderfully rapid; death ensuing within two days from the commencement of the attack. They are commonly confounded with pneumonic inflammation, and are scarcely to be distinguished from it during life but by the physical signs. The severest form of bronchitis is, however, more formidable and rapid in its course than pneumonia itself.

In the extremes of age, and in persons of weakly and phlegmatic habit, acute bronchitis frequently presents a form so different from what has been just described, that it is necessary to advert a little to these varieties. In young children a very fatal kind of bronchitis not unfrequently comes on in a most insidious manner. It may present at first the aspect of a common catarrh with coryza, without pain, much fever, or derangement of the general health. Attentive observation, however, discovers a frequency and wheezing in the breathing, which is uncommon, particularly before and after the fits of coughing; and the pallidity of the countenance and heavy state of the child's spirits indicate something more than a common cold. The cough is not always present, so that this symptom does not indicate the extent of the disease; and as children do not expectorate, the disorder in the chest may escape remark, until the dyspnœa suddenly comes on, and renders the danger imminent. Then the pulse becomes extremely quick, and the severity of the attack is evinced by the manner in which the respiration is oppressed, and the circulation disturbed. This aggravation of symptoms often goes off for a time, leaving the child in a somnolent state without much cough or quickness of pulse; but if the breathing still continues quick, the dyspnœa returns after a while with increased severity, the frequency of the pulse is increased, stupor comes on, the lips become livid, and in this, or in some succeeding similar exacerbation, the child dies suffocated.

The disease which resembles this more than the case before described, is that form of bronchitis which attacks old people and those of lax phlegmatic habit, and which bears the name of *peripneumonia notha*, or spurious inflammation of the lungs. Oppression of the breathing is here one of the earliest symptoms, and it is accompanied with a peculiar wheezing; but all the symptoms of inflammation are less acute than in the intense bronchitis before described; and the fever that attends is of a lower and less phlogistic type. There is perhaps a greater loss of appetite, and more disturbance of the gastric function; the tongue is loaded, and there is much thirst. The pulse is quick and wiry; the skin not much raised in temperature except in the evening. The dyspnœa is liable to temporary exacerbations, which are often so severe as to prevent the patient from lying down, and are accompanied by extinction of the voice. The expectoration is scanty at first, but afterwards becomes very copious and frothy. The terminations of this form of bronchitis, which Dr. Badham appropriately denominates *asthenic*, are much of the same kind as those of the more violent inflammation; but its duration is commonly longer, and it has a great disposition to pass into a chronic form. Persons liable to pituitous catarrh, or who have habitually a cough with copious thin expectoration, when attacked by bronchitis, generally suffer from this form.

Exciting Causes.—The usual cause of bronchitis is cold, particularly when conjoined with moisture, applied locally or generally, as for instance, by wearing damp clothing, or exposure to a cold, moist, variable atmosphere, especially after the body has been heated by exercise, crowded rooms, &c. But it appears that all sudden alterations of temperature from cold to heat, and certain epidemic states of the atmosphere also, are capable of giving rise to bronchitic affections. Irritating gases and vapours may excite inflammation of the bronchial membrane; but it is of the slighter kind, and soon passes away, unless the cause be again applied. A much more severe bronchitis accompanies some of the acute eruptive diseases, and frequently causes the chief danger that attends them. In some cases the eruption fades or is diminished, to the great increase of the bronchial affection, which is then announced by oppressive and dangerous dyspnœa. The inflammation of gout is sometimes translated in a similar manner in those predisposed to bronchial inflammation, and the suddenness of the attack renders these cases the more dangerous.

Physical Signs.—In investigating the pathology of acute bronchitis, we shall find that a much more accurate knowledge of the nature and extent of the disease may be obtained by a study of the physical signs than by any attention to the general symptoms alone.

Inflammation of the mucous membrane of the bronchi at first causes tumefaction, and consequently a diminution of the caliber of the tubes. This, occurring in individual points, so modifies the passage of the air through them, that, as in a musical instrument, a sound is produced. This sound varies according to the form of the constriction and size of the tube; but the general effect is, that on applying the ear to the chest we find the ordinary respiratory murmur accompanied by various whistling and wheezing sounds. These occasionally present a graver tone, like the prolonged note of a violoncello or the cooing of a dove, and then indicate that some of the large bronchi are the seat of disease. To such modifications of the respiratory sound, M. Laennec gave the names of the *sibilant rhonchus* and the *sonorous rhonchus*. They are the symptoms of the earliest stage of bronchitis, and are often perceptible before the patient is aware of any suffering in the chest. They prove moreover the fact, supposed by Dr. Badham and doubted by Dr. Hastings, that the dyspnœa of the early stage of bronchitis is caused rather by the state of the mucous membrane than by the redundancy of its secretion. Both the coarctation of the tubes by which air is scantily admitted, and the general thickening of the membrane by which the oxygenation of the blood is intercepted, appear to be the physical or pathological causes of the symptom in question. Percussion on the chest does not detect any loss of resonance.

In the progress of the disease, the auscultator soon discovers the presence of a liquid secretion, by the bubbling sound occasioned by the passage of the air in the bronchi. This is the *mucous rhonchus*, and its presence announces the second, the catarrhal or secreting stage of the inflammation. By practice the ear soon becomes enabled to distinguish the several sounds that are produced in tubes of different sizes; from these a pretty accurate estimate may be made of the situation and extent of the inflammation; and these circumstances bear a relation to the severity of the case. When the inflammation occupies only the large tubes, as is the case in common colds, the bubbles of the mucous rhonchus are large and uneven, and the sound of respiration may still be heard. But if the rhonchus is fine, and accompanies the whole of the respiratory act, it may be concluded that the disease is in the smaller bronchi; and if extensive, the function must seriously suffer. In this case there is sometimes a slight diminution of the resonance on percussion of the affected part. The passage of the secretion from a thin to a consistent state, commonly called the *ripening of the cold*, has likewise its distinctive symptom. The bubbles of the mucous rhonchus first become more interrupted, and gradually give place to a clicking, or a sibilant sound, occasioned by portions of the inspissated mucus partially obstructing the bronchi. Sometimes the respiration of a portion of lung is entirely obstructed by a pellet of this mucus in its principal bronchus; and thus the dyspnœa occurring at this stage of the disease is explained. These several symptoms are liable to frequent change from the removal or altered position of the mucus consequent on coughing or expectoration; and it is useful to avail ourselves of this in our examination; for we may thus prevent the mistake of ascribing absence of respiration to peripneumony or any other cause.

The varieties that we have before described as occurring in the progress and termination of acute bronchitis, depend on the character as well as on the extent of the inflammation. In the plethoric and sanguine temperament the inflammation is intense, and remains for a while dry; and the congested and thickened state of the membrane preventing the effectual arterialization of the blood, may in this stage cause dyspnœa. The copious secretion, however, that soon succeeds, and which appears to take place earlier in the dyspnœa of children, soon becomes an additional interruption to the function, and unless removed by expectoration or re-absorption, may soon amount to suffocation. The suddenness, as well as the abundance of its effusion, increases the danger of its effects; and this is the reason why cases of bronchitis suddenly supervening on a suppressed exanthema are amongst the most formidable. In old people, again, and those of a relaxed habit, there seems to be a serous infiltration accompanying the inflammation, which causes a greater straitening of the tubes in the first stage, than is usual in the other forms; and which is only relieved by a free secretion from their mucous coats.

Morbid Anatomy.—The anatomy of fatal cases of bronchitis, as far as it goes, is in perfect accordance with what we learn from the physical signs. The lungs do not in general collapse on opening the thorax; the escape of air being prevented by the obstructions in the bronchi. These in most instances contain a quantity of frothy liquid, of the quality of the matter expectorated before death. Not unfrequently it is mixed with bloody serum: but this, as it is not perceived in the matter expectorated, has probably exuded from the surcharged blood-vessels at the moment of and after death. Purulent matter is also sometimes observed, and mostly in very acute cases, which have proved fatal within four or five days. The mucous coat presents an appearance of red injection, diffused, or in patches, of various shades from a bright crimson to a brown red. It is sometimes thickened, but rarely softened; and never to the degree in which the gastro-intestinal mucous membrane is frequently found.

Diagnosis.—The diagnosis of acute bronchitis is to be deduced from the leading symptoms which we have given of the disease; and if we avail ourselves of the physical as well as the general signs, its character will be quite distinctively defined. It is distinguished from pneumonia by the nature of the expectoration, which, although in severe cases often viscid, is less so than in pneumonia, and wants altogether that rusty tinge so characteristic of the latter disease: it is also distinguished by the clear sound on percussion of the chest, and the absence of the crepitant rhonchus or bronchophony. (See PNEUMONIA.) From pleuritis, the clear sound on percussion is sufficient to separate it. Both these diseases may, in some cases, be confounded with bronchitis without reference to these tests, but these never fail to decide its character.

Prognosis.—The prognosis in acute bronchitis must depend on the extent of the disease. When the inflammation is partial, affecting a few bronchi only, as in common cases, and without much dyspnœa or fever, it may terminate in from six days to three or four weeks; and its disposition to pass off is always indicated by the expectoration becoming opaque and more consistent, and gradually diminishing in quantity. This change is always first observable in the mornings; the evening exacerbation restoring the thin glairy character to the sputa, even in cases tending towards convalescence. A relapse is marked by the expectorated matter becoming again transparent and glairy, and this is always accompanied by an aggravation of the cough and other symptoms.

In the more extensive attacks of inflammation, where the dyspnœa is great and unremitting, and particularly where the fever was high in the beginning, the prognosis may be very unfavourable; and if the acute symptoms have already yielded to the state of collapse, it is to be feared that the power of the system is insufficient to restore a function on which the disease has made a serious inroad. The extreme anxiety of the pallid countenance, and a slight appearance of lividity, announce the asphyxiating effects of this stage of the disease; and the universal mucous rhonchus, with little or no respiratory murmur heard on the application of the ear or stethoscope to the chest, gives direct evidence of impending dissolution.

There is sometimes accompanying continued fever a severe bronchial affection, which this examination alone can detect. There is little cough, and the general symptoms so mask the dyspnœa that it may proceed to a fatal termination without being distinguished from the symptoms of general weakness and oppression that severe cases of continued fever commonly present. (See FEVER.)

In severe bronchitis of children, likewise, the real amount of the danger can seldom be appreciated by the general symptoms in time for the effectual application of remedies; but where auscultation discovers, from a universal mucous rhonchus, that the inflammation is extensive, and occupies both lungs at once, great danger may be apprehended, whatever be the amount of dyspnœa and other symptoms at the time; for these frequently come on in paroxysms only, or are scarcely marked in the somnolent state in which the child lies during the remissions.

The danger in asthenic bronchitis, or peripneumonia notha, arises from the weakness and age of the patient; if these are great, there will be a great risk of the strength proving unequal to clear the lungs of the secretion that is so copiously poured out. The respiration of old people bears ill any sudden abridgment; for the more rigid texture of their lungs does not, as in younger subjects, admit of additional or supplementary respiration in the healthy parts. (See DYSPNŒA.) One of the most fatal forms of bronchitis is that supervening on a suppressed eruption.

Treatment of Acute Bronchitis.—1. The slighter cases of acute bronchitis are more frequently objects of domestic than of formal medical treatment. When neglected, however, a common cold may give rise to the most serious complaints; and we are far from subscribing to a prevalent opinion to which even Laennec seems to lean, that it must always run its course. By antiphlogistic diet, and a few simple means calculated to restore the secretions, and, if required, to cause revulsion from the inflamed part, a cold may often be checked in a few days, which if left to itself might run on for weeks, entailing on some subjects other and worse evils. The means which we have found most effectual are as follow:—At the first feeling of the cold, let a purgative be given, with two or three grains of ipecacuanha or James's powder. Let a hot pediluvium be used, the patient getting into a warm and well-covered bed immediately after, and promoting any disposition to perspiration by a warm draught of thin gruel, barley-water, or any other mild diluent. If perspiration comes on and the purgative operates well, the cold is sometimes already cured; and it is only necessary to remain at home, and to abstain from animal food and wine next day, to prevent a return.

If, however, perspiration do not follow, or if the cough has already come on, the disease generally proceeds, and we must then endeavour to mitigate its severity, and bring it quickly through its course. If the patient cannot, or thinks it not worth while to remain in bed for a day or two, he should clothe more warmly than usual; for the susceptibility of the body is such as to render a very slight exposure enough to keep up the disease, and abstinence from meat and all fermented liquors or spirits is at this period equally necessary. To loosen the cough and lead the bronchial inflammation to the stage of free secretion, small doses of ipecacuanha or tartarized antimony are often most effectual; and, although called a stimulant expectorant, squills, when combined with these, have always appeared to us to exert a beneficial effect: ten minims of the tincture with thirty of the vinum ipecacuanhæ, and six or eight of liquor potassæ, given three or four times a day, seldom fail to facilitate expectoration and relieve the cough. Whether the alkali act by facilitating the absorption of the medicine, or by any specific action on the vessels of the bronchial membrane, we cannot determine; but its effect in increasing the action of expectorants we have proved in a variety of examples. Should nausea be produced, the dose of the medicines may be diminished; and if the cough is still troublesome at night, a little extract or tincture of hyoscyamus may with advantage be added.

This treatment is generally sufficient to relieve the tightness across the chest, which yields as the cough becomes loose; but if the case is obstinate, it may be necessary to resort to a blister, or some of the means which we shall presently recommend for the more severe forms of the disease.

The inhalation of the vapour of warm water may be sometimes useful; but we have seen it in some instances increase the oppression; and from its effect of determining blood to the part, we do not deem it so universally safe a measure in recent bronchitis as it has been represented to be.

With still more force would we object to the cure by spirits or wine, as recommended by Laennec; not that we doubt its occasional efficacy, but from the experience that where it does not cure, it greatly aggravates the inflammation. Towards the termination, when the matter expectorated has become thick and loose, and all febrile symptoms are dissipated, animal food and wine may be indulged in with impunity, and even with advantage. At this period, too, if the disease shows a disposition to linger, much good may often be obtained by using some of the stimulant expectorants, as myrrh, copaiba, &c.; and if necessary, the cough may be allayed by opium. This treatment will be noticed under the head of chronic bronchitis.

There are very many remedies which are in common use for coughs, which it is impossible here to advert to. The safest are those which are simply demulcent; many are stimulant and narcotic, and often do mischief. Ipecacuanha lozenges is a remedy worthy to be named, as the convenience of its form recommends it when more formal medicines are objected to; and although it is apt to cloy the stomach before sufficient quantity can be taken, it often proves as serviceable as the less agreeable compounds of the medicine.

2. The danger attending severe acute bronchitis renders far more energetic measures necessary; and these, although generally of the same class as those usually directed against acute inflammations, must be exercised with more than usual discretion and caution.

As long as the phlogistic state continues, with high fever, hard pulse, and great feeling of straitness and oppression in the chest, there can be no doubt of the propriety of bleeding more or less freely, according to the intensity of the symptoms, and the strength of the patient; but it is not prudent, as in pleurisy or peripneumony, to bleed to syncope, or to push the measure with an expectation of very marked relief. From sixteen to twenty-four ounces may be taken at first in severe cases; and the repetition of general bloodletting must depend on the state of the pulse rather than on other symptoms. If it is weak, or if the patient is advanced in life, we must endeavour to subdue the symptoms by less violent means, such as local bleeding and medicines, rather than run the risk of destroying strength that is absolutely required for the act of expectoration.

Cupping is generally to be preferred to leeches, as its effect is more speedy and more within control; and it is of considerable advantage to apply it to the part in which auscultation has discovered the greatest obstruction to the passage of the air. There is an objection which obtains so against blisters, as to exclude their use in many cases of the early stage of acute bronchitis; namely, that before they rise, they always produce an irritating effect on the whole system, which is very apt to aggravate for the time the inflammation for which they are applied. This effect, however, varies much in different individuals, and in those whose skin easily vesicates under a blister, it is obviated by the serous discharge that immediately succeeds.

In other instances, it is advisable to resort to other counter-irritants, and we give the preference to the tartar emetic. To make it available in an acute disease, we have found it necessary to excite the skin previously to its application, by means of a brush or coarse flannel, by applying a warm hand wetted with ether or camphorated spirit, or by a short application of a mustard poultice The tartar emetic should then be immediately rubbed in, either in the form of a warm saturated solution, or an ointment composed of one part tartar emetic to two of spermaceti ointment. With these precautions we have rarely failed to excite a full pustular inflammation in as short a time as that required for the rising of a blister, with far less irritation to the system, and with decided relief to the pectoral symptoms. We have reason to believe that a minute quantity of the tartar emetic is absorbed into the system, as we have sometimes observed nausea succeed its use; and this, instead of being injurious, as in the case of cantharides, is a part of the treatment which has been found most serviceable. This brings us to the subject of internal remedies.

At the onset of the disease, the earlier the better, a brisk purgative should be given. Where the inflammation is high, calomel, with a grain or two of ipecacuanha, combined with jalap, scammony, or any of the active cathartics, is to be preferred, and followed by repeated doses of a saline aperient, containing a small quantity of tartarized antimony. This medicine proves useful not only as an evacuant, but as a sedative and diaphoretic, and the nausea, which it sometimes produces, is generally beneficial by modifying the secretion of the bronchial lining, and facilitating expectoration. For the same reason, a full emetic has been generally recommended, and is often decidedly useful; but it is better adapted to children, and to cases in which the bronchial secretion is profuse, than to the more inflammatory forms of the disease.

For the relief of the dyspnœa and cough, those medicines are to be preferred which act on the vascular system. The sensation of dyspnœa is not to be looked on as one merely of discomfort, to be relieved by means which deaden sensibility, but as an indication of the inroad made on a vital function, which, if not restrained, must terminate in its destruction. To aid, therefore, the antiphlogistic measures that we have already recommended, it is proper to administer such medicines as are likely to moderate the action of the vessels and relieve the congested lungs. Tartar emetic, digitalis, and colchicum best answer this indication, and we generally prefer the two former. The tincture of digitalis, in the dose of eight or ten minims, with thirty or forty of the liquor antimon. tartar., three or four times a day, is the form which we usually adopt. Of course it will be necessary to watch the effects of these medicines, and to diminish or discontinue the digitalis if the pulse become intermittent. It will be of considerable advantage to increase the dose of tartar emetic; and if the dyspnœa continue, and the mucous rhonchus in the chest is undiminished, to persist in its use even should it excite vomiting; for its beneficial effects in peripneumony, to which bronchitis, in its severe form, really approaches very nearly, are sufficient to prove its power to restrain effusion and promote absorption. Dr. Badham strongly recommends this medicine in doses "frequently repeated, and increased till the maximum which the stomach can bear without vomiting is attained."

Calomel and opium combined, and given in frequently repeated doses, as in other acute inflammations, are likewise sometimes highly beneficial; and we consider that their use is especially indicated, where, as is not unfrequently the case, the bronchitis is complicated with gastro-hepatic disease. The opium should be in smaller proportion than usual, and is, perhaps, most safely given in the form of Dover's powder.

Should the collapsed stage have come on, and the symptoms of debility show that the function of respiration has been already so much injured as to reduce the excitability of the system, it is necessary to resort to expectorants of the stimulating kind. Of these the best is carbonate of ammonia, which often enables a patient to expectorate what in his weakness might be sufficient to suffocate him. We are disposed to think that this remedy is more than an ordinary stimulant, and acts in an especial manner on the bronchial membrane.

The attenuating or solvent power of alkalies may with advantage be resorted to in the latter stage of bronchitis, when the matter of expectoration is very consistent, and, lodging in the bronchi, occasions local absence of the sound of respiration, and, if copious, dyspnœa. The liquor potassæ, in doses of ten minims, given with the vinum ipecacuanhæ, is productive of obvious benefit.

From what we know of the effects of the lobelia inflata in suffocative catarrh of the chronic kind, we should judge it to be worthy of a trial in the collapsed stage of acute bronchitis.

Besides attempts to relieve the lungs of the load which prevents the penetration of air into them, another indication presents itself in this stage, which is to obviate the bad effects of black blood in the system; for this it is, unquestionably, that gives that peculiarly depressed and adynamic type which precedes the fatal termination. Here, unfortunately, our experience fails us; and we feel the necessity of appealing to further researches of experimental physiology.

3. It remains for us to notice the modifications of treatment which the several varieties before described require.

In the bronchitis of young children emetics are peculiarly serviceable; for besides the beneficial effect they produce on the inflamed membrane itself, the muscular action of vomiting greatly assists expectoration, which can scarcely be effected at this age. Purgatives, too, are generally of more marked utility than in adults, and, if repeated, may frequently prevent the necessity for general bleeding. Dr. Hastings, however, highly recommends bleeding from the jugular vein; and in imminent cases this is probably the means most to be relied on. Dr. Badham suggests opening a vein in the foot, and immersing it for a few seconds in warm water, which causes blood to flow in sufficient abundance. In these cases, especially, we never can proceed confidently in the treatment without frequently appealing to the physical signs. The disease is so deceitful, (as Dr. Hastings remarks,) that except the universal mucous rhonchus, which nearly or entirely obliterates the respiratory murmur, no indication of the imminent danger can be discovered.

In the asthenic form of the disease in adults, bloodletting is rarely admissible, and never to a great extent. To restrain the secretion in the bronchi, and to rid them of it by means which do not greatly impair the strength, are here the obvious indications. Nauseating doses of tartar-emetic, or even larger, continued as in pneumonia until *tolerance* is established, purgatives, and derivatives, better fulfil these intentions. Blisters answer better here than in the more inflammatory disease, but to be effectual, they should be ample; and it is useful to give squill and digitalis (ten or fifteen minims of the tincture of each, three or four times a day,) during their operation; for the secretion of urine is thus kept free, and there is less chance of irritation of the system by the cantharides. Dr. Badham recommends assafœtida in the occasional aggravations of the dyspnœa, which he supposes to arise from a temporary spasm in the bronchi. The asthenic form of bronchitis leaves a greater weakness than the more inflammatory; or rather, we should say, the weakness is the consequence of the habit of body which causes the disease to assume the asthenic form. It is therefore generally necessary to use tonics after it to restore the strength; and if an irritable cough remains, without any excitement, opium may be resorted to to allay it. Change of air may sometimes effectually answer both these purposes, and will generally be found a beneficial adjunct.

It is generally necessary to be peculiarly energetic in the treatment of bronchitis supervening on suppressed discharges and eruptions. Extensive counter-irritation, as recommended above, with tartar-emetic, would seem here to be especially indicated. In case of repulsed gout, means should be taken to bring the gouty inflammation back to the limb by mustard poultices and hot water; but these measures are not solely to be depended on.

II. Chronic Bronchitis.—Chronic bronchitis presents as great a variety of form as the acute disease; and from the complications into which it very frequently enters, it is less tractable in its nature. It is not an easy matter to define distinctly the character which entitles a case of bronchitis to the specific term *chronic*. The duration of the acute disease is very varied; and it is frequently renewed for such a length of time as might truly gain it the name of chronic. The distinction which Andral gives, although by no means perfectly exact, is perhaps the best, inasmuch as it is founded on the pathology of the mucous membrane itself. As long as the expectorated matter remains glairy and viscid, uniting in mass, and without opacity, the inflammation is acute. Towards the termination of an attack of this kind, the sputa become opaque, and are expectorated in distinct masses, which, although consistent, are not very adhesive or glutinous. Sometimes, instead of diminishing and becoming more consistent, as when the disease is about to terminate, they remain in this state, or increase and become diffluent and heterogeneous in quality, without sensible increase of fever; and they then indicate inflammation of the chronic kind.

Chronic bronchitis in its slightest form manifests itself only by habitual cough and expectoration, which are increased by certain changes of weather, and generally prevail most in winter and spring. It is most common in advanced life; and in fact very few old people are perfectly free from it. In its severer forms it is accompanied with dyspnœa, occasional pain in the chest and about the præcordia, and some febrile symptoms, especially towards evening, palpitation, and disorder of the digestive functions. The cough is sometimes very severe, especially at night, and the expectoration copious; and if these persist long, they seldom fail to waste the body and reduce the strength.

The character of the expectoration is various. Generally it consists of a greenish-white mucus, or it may assume a muco-purulent appearance, and is often mixed with little thin pituita. Sometimes the pituita are abundant, as in pituitous catarrh, and a few masses of brownish or ash-coloured mucus float in it. Sometimes it is purulent, and streaked with blood; and in some cases it is real pus, presenting all the varieties that are seen in pus from other sources. In such instances there are generally a quick pulse and signs of hectic; and the disease tends to a fatal termination, with night-sweats, emaciation, diarrhœa, and all the common symptoms of pulmonary consumption. The worst cases are usually those which succeed to repeated or severe attacks of acute bronchitis, whether of the intense or asthenic form.

Exciting Causes.—When occurring in early life, chronic bronchitis generally follows hooping-cough, measles, small-pox, or some cutaneous eruption, and does not often succeed to an acute attack. A very distinct form of chronic bronchitis is excited by the habitual inhalation of air loaded with dust. Needle-pointers, stone-cutters, those who powder and sift the materials for making china, and leather-dressers, are particularly liable to this affection. In these cases it usually begins with dyspnœa, which may continue for a considerable time before the disease declares itself. In the course of a few months, however, the dyspnœa is increased, and accompanied by severe cough and a copious expectoration, sometimes mixed with pus and blood. Not unfrequently the cough brings on a profuse hæmoptysis. At this time the constitution generally suffers much; the pulse becomes quick; thirst and fever attend; the tongue is loaded; and the aggravations of dyspnœa occasion lividity of the countenance. Unless these symptoms are relieved by remedies, and a total abandonment of the unhealthy occupation, they become worse; the expectoration increases to a great extent, and becomes more purulent; hectic, with night-sweats, succeeds; and the patient dies with most of the symptoms of tubercular phthisis. (See ARTISANS, DISEASES OF.)

Physical Signs and Pathology.—The physical signs of chronic bronchitis do not materially differ from those of the acute disease. The resonance of the chest on percussion is scarcely if at all impaired. The respiration is varied in its distinctness, being often louder than usual, but occasionally obscure, and accompanied with mucous rhonchus. This rhonchus is not universal over the chest, and seldom accompanies the whole of the respiratory act. It very rarely happens, as in the latter stage of acute bronchitis, that the respiration is completely interrupted in a part of the lungs; and this proves that the mucus is in a more diffluent state, and yields to the air passing through the bronchi. Occasional sonorous and sibilant rhonchi prove the partial obstruction of the air-passages; and this may be either by a thickening of the mucous membrane, or by portions of thick mucus; but these symptoms are not so common in chronic bronchitis as in the dry and pituitous catarrhs.

A remarkable feature in chronic bronchitis is, that dyspnœa is not unfrequently present to a considerable degree, when from the sound heard in the chest it is plain that the air enters the lungs as well as or better than usual; the respiration being distinct or even puerile. For a complete consideration of these apparently contradictory phenomena we must refer to the article DYSPNŒA, and shall merely remark here, that the nature rather than the quantity of the bronchial mucus is probably the cause of the symptom in question.

The continuance of inflammation has the effect, ultimately, of altering the texture in the mucous membrane of the bronchi as in other parts. Its greater tenuity and simplicity of structure exempt it from a number of the changes which are incident on the gastric and intestinal mucous membranes; but it is nevertheless subject to softening, ulceration, induration, and thickening; and the effects that these produce on the caliber of the bronchi are worthy of our attention.

Morbid Anatomy.—The mucous membrane is frequently found, on dissection, of a deep red colour, the redness being diffused or in patches. It is of a more livid or violet tint than in the acute disease, where it is usually brighter and more verging on brown. Not unfrequently, however, the membrane is quite free from this; it is sometimes even whiter than usual, and this in cases where there has been copious purulent expectoration. Softening does not occur to the extent to which it goes in inflammation of the gastric mucous membrane, and the simpler nature of the membrane explains this. (See SOFTENING OF ORGANS.) Ulceration is also rare, particularly in the smaller branches of the bronchi, except in those cases which arise from the inhalation of dust, in which the mucous membrane is generally ulcerated, often to a considerable extent; and the thickening and general alteration of structure are greater than in the ordinary cases of chronic bronchitis. The ulcers are usually small, clean, and do not extend below the mucous and sub-mucous coats. Thickening of the membrane is a more common effect, and it sometimes occurs to a very notable extent, nearly obliterating the cavity of the tube. It is rarely uniform, but generally affects several points, particularly at the bifurcation of the tubes.

Another and very remarkable state, produced by chronic bronchitis, is a *dilatation of the bronchi.* It is not of very unusual occurrence, and presents itself to the anatomist in different forms. Sometimes a single tube is dilated at one or more points into a sac of various sizes, in some examples capable of containing a walnut. In other instances the dilatation is uniform, and extends to several tubes, which enlarge, instead of diminishing, as they divide. Thus a bronchus of the size of a straw is seen to dilate to that of a goose-quill. Sometimes several branches from the same tube are affected in this manner. The mucous membrane can always be distinctly traced from the undilated portions of the tubes, and usually with some difference in its texture. It is sometimes thickened; in other instances so extremely thin as to give the dilated portions the appearance of shining vesicles amongst the pulmonary tissue. Occasionally either the mucous membrane or the circumjacent coat becomes considerably indurated, so that the dilatations are rigid, and scarcely susceptible of compression or dilatation; but the mucous membrane is more frequently softened, so that it can be scraped off by the nail.

These dilatations, as the diseased bronchi in general, are frequently found full of pus, mucus, or whatever kind of matter has been expectorated before death.

Laennec considers these organic changes to be produced simply by the thick mucus accumulating and gradually causing a mechanical distension of the tubes. But in this case we should discover more frequently an absence of the respiratory sound in the part: such a sign, although common in the latter stage of acute bronchitis, scarcely ever occurs in the chronic disease. We are more disposed to ascribe them, with Andral, to the altered texture of the membrane; but even this is only the predisposing cause. The physical cause of dilatation of the bronchi, we apprehend, is to be found in acts of respiration and cough exerting a degree of pressure on the softened membrane, greater than its elasticity can resist. Thus the forcible inspiration which succeeds each fit of coughing acts with greater effect on these weaker parts; and again, the violent expiration of coughing brings an undue pressure on the same tubes, which, distended in one part, and partially obstructed by the thickening of their membrane in another, are perpetually exposed to a straining influence. Induration, the effect of another degree of the inflammatory process, sometimes succeeds, giving the dilated portions that rigidity that is occasionally noticed in them. The effect of these dilatations must be to obliterate the neighbouring cells, and to abridge the function of the lung. Accordingly the adjacent tissue is found, on dissection, to be dense, and deprived of its cellular structure; and when extensive, the disease thus causes habitual dyspnœa.

Diagnosis.—The characters of chronic bronchitis are such as easily to distinguish it from all diseases except pulmonary consumption. The severer forms sometimes so closely resemble this disease, that it is impossible to distinguish them by the general symptoms; and even with the aid of auscultation and percussion the distinction is often very difficult. The presence of pus in the expectoration, which was formerly considered characteristic of phthisis, is, we have already seen, very common in chronic bronchitis; and in fact, that which occurs in the course of phthisis, proceeds more from the inflamed bronchial tubes, than from the tubercular excavations themselves. So likewise, hectic, night-sweats, emaciation, and diarrhœa, frequently accompany both diseases.

When unattended with dilatation of the bronchi, an attentive examination of the physical signs will, however, enable us to form a pretty sure diagnosis. It is in the absence of the signs of phthisis that we recognise the character of chronic catarrh; and as this negative test is weaker than positive proof, so it is necessary that it should be often repeated to produce certainty. If, after having repeatedly examined the patient, at different hours, during several weeks, there are found no gurgling cavernous rhonchus, no cavernous respiration, no pectoriloquy, and no constant absence of the respiratory murmur, and of the sound on percussion, we may, with tolerable certitude, pronounce the disease to be simply pulmonary catarrh; and a still further multiplication of examinations will remove all doubt.

But if there be considerable dilatation of the bronchi, the same signs which are produced by tuberculous excavations in phthisis may likewise occur in chronic bronchitis. If the dilatation is produced at one part of the tube, and is of a rounded shape, it may be the seat of pectoriloquy and cavernous rhonchus, in the same manner as a tuberculous cavity of the same size: but if, as is the more common case, the tubes are more uniformly and generally dilated, the vocal resonance in the tubes scarcely amounts to pectoriloquy, but is rather a loud bronchophony; and the breathing is accompanied with a *whiffing* sound, more distinct than the bronchial respiration of peripneumony. It is only by attention to the progress of such cases that they can be discovered not to be phthisical. A tuberculous excavation rarely remains stationary as these do, but enlarges and gives a pectoriloquy of a greater extent; whilst other excavations are usually formed in other parts. Dilated bronchi rarely affect the sonoreity of the chest on percussion to the degree that the engorgement and infiltration about tubercular excavations do; nor can they produce the other physical signs of large cavities. The most common situations of dilated bronchi are in the scapular, mammary, and lateral regions: the subclavian and acromian are the more usual seats of phthisical signs.

The only instance in which the sputa can assist in the diagnosis is, when they declare themselves phthisical by the presence of tubercle, or portions of the pulmonary tissue; in other respects they may be exactly the same. A remarkable fœtor has been repeatedly observed in the sputa where the bronchi were dilated.

It must be confessed that cases do occur, although rarely, which leave the most experienced auscultator in uncertainty; but these are exceptions of comparatively little practical importance, and hardly detracting from the utility of acscultation. For it need scarcely be remarked that dilatation of the bronchi is quite incurable; and it is often connected with such extensive lesion of the bronchial membrane as would leave the prognosis the same as in phthisis.

Prognosis.—The prognosis in chronic bronchitis depends very much on its origin, and on its simplicity or complication with other disorders. When succeeding to an acute attack, and when unattended with much derangement of the general functions, it does not tend to a fatal termination. Even should there be some purulent expectoration and hectic, favourable circumstances will sometimes bring about a cure; and slighter forms, though obstinate and lasting for years, seem scarcely to have any effect in abridging life. But in its worst character, with constant dyspnœa, copious purulent expectoration, hectic, and emaciation, and especially if attended with symptoms of confirmed disease in the abdominal mucous membrane, or in the liver, it is nearly as fatal as phthisis itself. In these cases of complication, the bronchitis is frequently secondary; and there are abundant examples which prove that it may disappear entirely, if the abdominal disease is of a tractable nature, and yields to treatment.

In many cases the prognosis must depend on the nature of the physical signs: the disease is itself an attendant on phthisis; and if these do not establish with certainty that tubercles are not present, the case must always be considered of doubtful prospect. In the first stage of phthisis an extensive bronchial inflammation frequently attends, when the tubercles are very numerous and generally dispersed, before the stage of softening has come on. In all cases, therefore, which the history and constitution would indicate to be phthisical, the presence of a general mucous rhonchus, with partial dulness on percussion, must be considered a sign of the worst import, for a tubercular disease of this description generally runs a speedy and fatal course.

The cases of simple bronchitis that prove fatal are those in which the mucous membrane has become so altered in its structure and function, that it permanently impedes the oxygenation of the blood, and wastes the body by its secretion, and the wearing efforts to evacuate it. These generally occur in old persons, and those already reduced by fever or a severe attack of acute disease. [*Bronchitis asthenica*, *Bronchorrhœa*.] One effect of the constantly imperfect oxygenation of the blood which attends bronchitis, is a stagnation and congestion of blood in the lungs and heart; hence organic diseases of the heart, and effusion of blood and serum, not unfrequently supervene to its long continuance.

Treatment of Chronic Bronchitis.—In the treatment of chronic bronchitis, as of all chronic diseases, regard must be paid to the time required for the cure, and the strength economised accordingly. Unless in case of a temporary increase of pulmonary congestion, or aggravation of inflammation, bloodletting is not admissible; for besides its bad effect in adding to the weakness, which is one of the worst characters of the disease, it has but little power to control the action of vessels under the influence of chronic inflammation. Those remedies are to be preferred which act on the extreme vessels, whether directly, in the diseased part, or by establishing a new action in another part of the system.

The objection which we urged against blisters in the acute disease does not apply here; and they are often in a high degree serviceable. It is generally necessary to repeat them several times; for few cases yield to a single application. In some constitutions they produce a great prostration of strength, and in others their beneficial effects do not continue: in such cases an effective substitute will be found in tartarized antimony, as recommended in the acute disease. The suppurative inflammation that this excites is often more efficacious in removing inflammation from a deep-seated part than the irritation of a blister, the effects of which usually cease with the serous discharge. When it happens that a blister suppurates, a more permanent benefit is obtained; but keeping up the irritation by means of cantharides or savine ointment has not the same effect, and is more painful than salutary. Counter-irritation by tartar-emetic may, by attention, be regulated to any degree; and by slight re-application a constant succession of pustular eruptions may be continued for months, if required. From this measure, conjoined with internal medicines, we have seen the happiest results in cases of the most formidable aspect; and we have scarcely ever known it fail to give some relief. It seems to moderate the irritation and secretion of the bronchial membrane, which often changes from purulent to mucous during its use; and it enables the system to bear a tonic and nutritive regimen without aggravation of the bronchial disease. It is by the success of a measure of this kind that a well-known modern empiric has gained a name famous enough to blind many to the gross ignorance with which he has applied it.

[Dr. Graves (*A System of Clinical Medicine*, Dublin, 1843,) has recommended the formula published at page 222 of this volume, as an imitation of the liniment of this empiric, (St. John Long,) which, he affirms, is an easily manageable and efficacious remedy.

A large portion of the chest may be sponged daily with the liniment, so as to keep up an erythematous state of the surface.]

The utility of expectorants in the chronic form of bronchitis has been called in doubt by the question—on what principle can they be prescribed, when the secretion is already redundant? But let it be remembered that the power of expectorants is not confined to increasing the bronchial secretion; they tend also to modify it. Thus, in acute catarrh, under the same expectorant that at first tends to *moisten* the cough, the mucous secretion becomes consistent, diminishes, and gradually returns to its healthy state. Ipecacuanha is certainly capable of producing this effect, and is perhaps the most generally useful expectorant that we possess. In some cases it may be given with great advantage in emetic doses, repeated every two or three days. In some obstinate examples of the milder form of the disease attacking persons of robust habit, this practice has effected a cure. As an expectorant, it may be given in the dose of a grain or two of the powder, or twenty minims to ʒss of the wine, repeated several times in the day, according to its effects, and combined with squill, colchicum, digitalis, and opium, as the case may require. It is a useful adjunct to any expectorant medicine, and is only contra-indicated in case of profuse night-sweats.

Squill is of decided utility in some instances of chronic coughs, but rather in cases which are slighter and unattended with purulent expectoration. It is generally useful to combine it with an alkali; and a small quantity of opium may be added to prevent it from passing off too rapidly by the kidneys.

Wherever the circulation is much accelerated, and the dyspnœa is distressing, the tincture of digitalis is very likely to afford relief; and those cases which simulate phthisis are frequently fit subjects for its use; but it is necessary to watch its operations, both on account of its effects on the circulation, and its tendency to disorder the stomach and digestive organs. The same thing may be said of colchicum, which is highly spoken of by Dr. Hastings, who recommends the tincture in the dose of twenty drops three times a day, increased or diminished according to the effects.

The *lobelia inflata* is a medicine less known in this country than it deserves. Its action seems to be of the same class as colchicum and squill, but it is more decided in its effects, and therefore likewise requires greater care in its exhibition. It may be tried first in the dose of ten minims of the tincture three times a day; in many cases this may be increased to forty or fifty; but in others not more than five minims are borne without nausea, vertigo, and a feeling of faintness. From the manner in which it relieves the dyspnœa, it is probable that it operates as a sorbefacient as well as an expectorant. It is especially serviceable in those aggravations of chronic catarrh, which Laennec designates by the title of *suffocative*, and which do, in fact, sometimes produce suffocation.

In such cases, likewise, ammonia becomes a valuable remedy; and the one, in extreme cases, when suffocation is threatened, on which we must principally depend. From five to ten grains of the carbonate may be given in camphor mixture, and repeated, if necessary, every hour or half hour, according to its effects. In the weak and atonic cases, without profuse expectoration, it is a useful adjunct to squill, ipecacuanha, and other medicines, instead of the fixed alkalies; and, conjoined with assafœtida or musk, it is well suited to diminish the convulsive character of some habitual coughs, which are very apt to wear down the patient, and deprive him of his nightly rest.

[Tar-water was at one time greatly extolled in pulmonary affections, and, among the rest, in pulmonary catarrh, and in chronic bronchitis; and since the discovery of creasote — the main active ingredient in tar-water — fresh trials have been made with it. It is occasionally of service, where the ordinary excitant expectorants are indicated. Creasote itself has been given in the same cases; but it does not seem to possess more virtue than tar-water.]

It would be endless to go through all the remedies that have been extolled as effectual expectorants in chronic bronchitis. All the balsams and gum-resins have enjoyed this reputation, and fallen again in disrepute: some, as copaiba and myrrh, have been resumed by some practitioners, and not without reason; but their utility is limited to cases of the atonic kind. Myrrh we have found really serviceable, particularly after a course of the other expectorants, when its grateful and tonic effects on the stomach give it an additional recommendation. Copaiba frequently disagrees with the stomach; but when it is well supported, it often restrains and modifies the bronchial secretion. Neither of these medicines is eligible when fever or vascular irritability is present; and it may be considered a matter of doubt whether they do not act rather as general stimulants than peculiarly on the bronchial membrane.

[The acetate of lead has been thought worthy of great reliance in bronchitis accompanied by profuse secretion; its administration being limited to the period of the disease in which the secretion is excessive. The dose should not exceed twelve grains in the day, to the adult.]

There is a class of remedies from which, if they were better known, much good might be expected; those, namely, directly applied to the diseased membrane itself by inhalation. The vapour of water does not seem to possess any property to recommend it in chronic bronchitis, unless it be in those rare cases of deficient or very viscid secretion, where it may be of some use in relaxing the vessels and facilitating expectoration. Whether combining it with chlorine or with the vapour of iodine, as lately practised in Paris in consumptive cases, may be of any avail in this affection, we want data to determine. It is probable that they can scarcely be exhibited for a sufficient length of time to be effectual in a very diluted form; and when stronger, they decidedly irritate and prove injurious.

The diffusion of the vapour in the air of the apartment, as has been done with tar, is a preferable method, as it ensures the constant application of the remedy without extra fatigue to the patient. The inhalation of tar-vapour has had repeated and extensive trials since Sir A. Crichton directed the attention of British practitioners to it; and although its utility in phthisis has not been confirmed, many have testified to its beneficial effects in certain cases of chronic bronchitis. As it is of a stimulating nature, it proves useful only in cases free from irritability or from tendency to active inflammation; and it is important to watch its effects when first employed, and to diminish or withdraw it altogether, if it decidedly aggravates the cough, and quickens the circulation.

[Iodine has been administered;—at times, alone; at others, associated with conium, as advised by Sir Charles Scudamore, in tubercular phthisis (q. v.); but whilst some extol it highly, others have not observed the least benefit from it. Conium, and other narcotics, have been used in the same manner — twelve or fifteen grains of the extract being diffused in an inhaling apparatus, and the vapour drawn into the lungs for a quarter of an hour, once or twice a day.]

Another class of remedies may in many instances of chronic catarrh be judiciously conjoined with those already noticed; those, namely, that deaden sensibility, and allay that mobility of the muscular system which greatly increases the length and frequency of the fits of coughing. The most powerful of these narcotics, of course, is opium; but on account of its tendency to check secretions and increase local congestions, it cannot with propriety be given alone, unless occasionally, for the sake of obtaining a night's rest. In this case the acetate or sulphate of morphia, or any of the acid preparations of opium, such as Battley's liquor opii sedativus, is to be preferred; and these will generally be found to be safer medicines for habitual use, in combination with squill and ipecacuanha or other expectorants, than the tincture or solid form of opium. The tinctura camphoræ composita is also a very useful narcotic in chronic coughs of the less inflammatory kind.

There are other narcotics of very high utility, and which are free from the disadvantageous properties that opium sometimes manifests. At the head of these may be placed conium, the extract of which, in the dose of four or five grains three or four times a day, very signally relieves cough and irritation of the chest. Dr. Paris, who greatly extols this remedy, recommends the dose to be increased until it produce some giddiness, tremor, and nausea, or a heavy sensation and tightness in the forehead; unless some of these sensations are produced, he considers that the remedy has not had a fair trial. It is always advantageous to combine it with ipecacuanha; and the extract of hyoscyamus is indicated where an additional narcotic power is desired. The extract or leaves of belladonna, in the dose of a grain or two, we have found a useful adjunct where dyspnœa is present. The tincture of digitalis may be used with the same view; and either of these medicines is to be preferred to the hydrocyanic acid, which, notwithstanding the praises lavished on it, must be considered at least a very uncertain remedy.

Besides these means, directed against the local disease, it is of the greatest importance to attend to the state of the functions in general. Whenever any fever attends, the daily exhibition of a saline purgative is advisable. In the more atonic cases, if aperient medicine be required, a compound colocynth or aloetic pill is to be preferred; and where the cough shows a convulsive character, we have seen the greatest advantage result from the daily use of the pil. aloës et assafœtidæ combined with ipecacuanha.

Should there be, as there very often is, any complication with abdominal disease, it is of the first consequence that this be not neglected. Thus, when pain of the right side and shoulder, with fulness and tenderness in the right hypochondrium, stools of unnatural colour, a foul tongue and turbid urine, discover disordered function of the liver and alimentary canal, it will be proper to put the patient under such an alterative course of blue pill and the like medicines as may be best calculated to bring back the healthy action of these important viscera.

Again, where a florid tongue, tender epigastrium, frequent thirst, dry skin, and nightly accession of fever, indicate that the disease extends to the mucous membrane of the stomach and bowels, it is quite apparent that many of the remedies directed against the bronchial disease will not be borne or will prove injurious, until the gastritic disease be relieved by leeches and blisters to the epigastrium, castor oil, the mildest alterative aperients, and warm baths, with the most rigid regulation of diet. For more ample directions on this head we must refer to the several articles Gastritis, Dyspepsia, &c. Whether these diseases be primary or secondary is a consideration of less consequence than that, as long as they continue, the action of all remedies on the bronchial disease must be uncertain or prejudicial. Thus it is that even digitalis and colchicum may prove stimulant until the gastritic disease be subdued.

If due attention be paid to the removal of such complications, and if the disease do not present a decidedly inflammatory character, the weakness of the system may be combated by tonics, especially the sulphate of quinine. In case of profuse perspirations, these are scarcely to be dispensed with, and may properly be combined with sulphuric acid.

The diet in all cases of chronic bronchitis should be mild and simple in its nature. Farinaceous and milky food is that best adapted to the plurality of cases, particularly when accompanied by gastritic disorder; but in those cases that require nutrition in a smaller bulk, simple animal food is not to be withheld. Notwithstanding the eulogy bestowed by Laennec on the spirituous treatment of chronic mucous catarrh, we consider spirits and all fermented liquors in themselves as decidedly injurious; and they are only to be admitted in a very few cases, where their assistance in the digestive process is absolutely required.

It is scarcely necessary to insist on the importance of avoiding extremes and sudden transitions of temperature, improper clothing, and all those circumstances that are in themselves frequent exciting causes of the disease: when re-applied, they must necessarily prolong it; and not a few instances are met with where, owing to the nature of our climate, it is impossible sufficiently to avoid them. In these cases, in spite of the most careful administration of these remedies, the disease persists; but a perfect cure is effected by simple removal to a more genial climate. This is, perhaps, the most effective remedy that can be resorted to; and where the circumstances of the patient do not permit him to adopt it to its full extent, a change of air to the distance of a few miles may often be productive of good. The careful regulation of the air in his apartments must be his resource in the winter months. (See Climate and Phthisis.) It is of importance to attend not merely to the temperature, but also to the hygrometric state of the air; and it may be useful in some cases to follow Dr. Paris's plan of diffusing the vapour of water through the room during the prevalence of those dry easterly winds which irritate the mucous membranes, and aggravate the cough.

Of the means which may be called prophylactic against bronchitis, that of sponging the chest daily with salt water, or vinegar and water, deserves warmly to be recommended. If this, which may be practised by the most delicate, and the cold plunge or shower-bath for those stronger, were more commonly resorted to, the number of pulmonary invalids would be greatly diminished.

[But few invalids, who are subject to bronchitis, can bear with impunity the contact of very cold air with the pulmonary mucous membrane; hence they are compelled to breathe through folds of gauze, or to hold a handkerchief to the mouth, whenever they are exposed to it. An instrument has been invented by Mr. Jeffreys, called a *Respirator*, which consists of several strata of fine wire, through which the air can pass with facility; and, in its passage, have its temperature modified, so that no irritation is produced in the lungs. The invention is ingenious and useful.]

C. J. B. Williams.

[III. Acute Epidemic Bronchitis. (See Influenza.)

IV. Summer Bronchitis.—This singular affection has received various names. It has been called *Summer Catarrh*, *Hay Asthma*, *Hay Fever*, and *Rose Catarrh*, and is met with in the summer and autumnal seasons, both in this country and in Europe. It has received those various names as indicative of the period of the year at which it occurs, or of the causes that give rise to it.

Diagnosis.—The most common symptoms are itching of the eyelids, and, at times, of the inner canthi of the eyes, with irregular attacks of violent sneezing, sense of weight in inspiration, and, at times, considerable dyspnœa, copious discharge from the Schneiderian membrane, redness of the conjunctiva, and sense of weight in the forehead, with suspension—partial or entire—of smell and taste during the continuance of the disease. The exacerbations have been commonly observed to supervene in the morning, a short time after rising; but frequently they appear several times in the course of the day. Many letters have been published from patients descriptive of their sufferings from this strange malady. (Elliotson's *Principles and Practice of Medicine*, Rogers's edit., p. 720: Lond. 1839; and the writer's *Practice of Medicine*, 2d edit., i. 273: Philad. 1844.) The attacks appear at times with such regularity, that individuals have made it a point to transact important business prior to a certain day of the year; being aware, from their experience, that on that day they are almost certain of the presence of their annual visiter.

The functional phenomena of the disease do not place it, as one of its names would import, under nervous or spasmodic asthma. It appears to consist essentially in inflammatory irritation of the mucous membrane of the eyes, nose, and the whole respiratory apparatus,—the dyspnœa originating in this cause. It is rather a form of chronic or subacute bronchitis, and scarcely to be regarded as a combination of catarrh and asthma, as it has been by some.

Causes.—The prevalent idea is, that summer bronchitis arises from vegetable matter diffused in the atmosphere; that it is derived from the flowers of certain plants, and that, in a great number of instances, it comes from grass or hay; but it is against the notion of the effluvia from hay being a common exciting cause, that haymakers themselves are said to be entirely free from it; and that it is often met with in towns, where such effluvia, if they exist at all, cannot be in any considerable quantity.

The rarity with which the disease is seen sufficiently proves that the predisposition lies in idiosyncrasy, which would seem at times to be derived from progenitors. When such predisposition exists, the smell of hay may act as an exciting cause; but in other instances it may be an emanation of a very different kind. The odour of ipecacuanha is one of the most frequent excitants: with others, the same effect is induced by the smell of the rose, the bean-flower, the guinea-pig, &c. &c.; and the case of an English nobleman is recorded, who is affected with sneezing and asthmatic symptoms if he touches a hare, or rather the fur of a hare. Cases of periodical bronchitis, analogous in their character to hay asthma, occasionally occur in which hay can by no means be ranked as a cause. An interesting example of this kind has been given by the writer elsewhere. (*Practice of Medicine*, i. 275.)

Treatment.—It does not appear that much advantage is derived from medicine in this disease. The cold shower-bath has been regarded as the best prophylactic, especially when associated with the internal use of the sulphate of quinia and the sulphate of iron, which, although not wholly compatible chemically, form a compound that has been productive of advantage; two or three grains of the former and one grain of the latter being given three times a day. A journey to the seacoast has likewise been advised, and, from change perhaps, the paroxysm has been prevented. When the disease is fairly formed, it runs its course greatly unmodified by remedies. It does not bear depletion well nor a sedative course; yet a drachm of the tincture of lobelia three times a day is asserted by a recent writer to generally afford relief; whilst another has found a cup of strong coffee without sugar or milk the most successful remedy.

Too rigorous a diet and too free exposure to air have been prejudicial to almost all.

Distressing as the affection is, it is consolatory to know, that during the autumn it gradually ceases and disappears,—too often to recur at the same period in subsequent years. The efforts of the practitioner can only palliate the urgent symptoms, and even in this respect his powers will be found very limited, and his attempts to afford relief too often either wholly nugatory, or productive of unexpected aggravation of the symptoms.

ROBLEY DUNGLISON.

BRONCHITIS ASTHENICA. (See BRONCHITIS, CHRONIC.)]

BRONCHOCELE means, literally, a swelling of the throat, from βρόγχος, *guttur*, and κήλη, *tumor*; and, in fact, every indolent tumour on the fore-part of the neck, until recent times, passed under that denomination. Modern physicians, however, have confined the term to a chronic enlargement of the thyroid gland, sometimes complicated with a morbid growth in the surrounding structure. There is no precise name for the disease in this country; but, from being more common in Derbyshire than other parts, it has sometimes been called the "Derbyshire neck." In Switzerland, where in many parts it is endemial, it is called goître, probably a corruption of *guttur*, and is generally an attendant on that humiliating state of body and mind known by the name of *cretinism*. There is, however, by no means an invariable fellowship between the two diseases, although Professor Fodéré has ascribed the mental imbecility to the state of the gland, (Traité sur le Goître et le Crétinisme, 8vo., Paris, an 8,) and Dr. Rush, of Philadelphia, has even deduced a theory respecting its uses from this supposed causation among other things, (Medical and Physical Journal, vol. xvi. p. 208.)

The tumour, as we have stated, is of a chronic or indolent nature, increasing gradually, and often continuing for many years, or even a whole lifetime, without affecting the general health. It usually appears in early life, and is much more common among women, especially those of a lax fibre, than among men; insomuch, that in this country it is very rarely met with in the male sex. [It would seem, however, that in Switzerland, and in some parts of India, where the disease prevails extensively, the proportion of males is greater.] In all the cases admitted at the Hampshire County Hospital during the last ten years, amounting to forty-nine, the patients have, with only one exception, been women. We are informed by Dr.

Forbes, that out of seventy patients treated at the Chicester Dispensary and Infirmary during the last nine years, only two have been males. It is also worthy of notice, that both the latter cases occurred in boys of a very feeble and feminine habit of body, and very backward for their years. The disease has, in some instances, been observed to make its first appearance during parturition, and, in other cases, to have made rapid progress during gestation or suppression of the menses, (M. *Brun*. Thèse sur Bronchocèle. Paris, 1815.) The swelling generally embraces the whole gland, but is sometimes confined to the lateral lobes, or the middle lobe, separately. It is usually soft and rather flabby to the touch, though somewhat unequal in that respect, and is for the most part free from pain and of a natural colour. It varies in shape, at first presenting but little outline, and while of moderate dimensions, possessing a more rounded and compact appearance than it afterwards preserves. When of considerable size it has a pendulous form, not unlike the dewlap of a turkey-cock, the bottom being the largest part. In point of magnitude it varies still more remarkably; often remaining through life of no very conspicuous size; in other cases increasing to a degree of hideous deformity: sometimes it rises as high as the ears. Alibert mentions one instance in which it descended to the middle of the sternum; and another in which it was of a tapering cylindrical shape, and reached to the middle of the thigh, (Nosologie Naturelle, t. i., pp. 466–468. Paris, 1817.) In cases of great enlargement it impedes respiration, deglutition, and the return of the blood from the head, by its pressure; thus occasioning hoarseness, wheezing, flushings of the face, headach, giddiness, and, in some instances, even death. In these extreme cases there are occasional pains in the tumour, and the skin becomes of a livid appearance, with the veins on its surface much swollen. The late Dr. Parry, of Bath, often observed bronchocele to follow diseases of the heart, epilepsy, and other maladies in which the blood is propelled with excessive momentum to the head, (Elements of Pathology, p. 187, 8vo. Lond. 1815.) Flajani has seen it accompanied with palpitations and irregular and intermitting pulse; and he believes that fatal disease of the lungs has been induced by the consequent disorder in the pulmonary circulation, (Collezzione d'Osservazioni e Riflessioni di Chirurgia, t. iii. p. 283, 8vo. Roma.)

On dissecting the tumour, Hunter and Baillie found it to contain cells with a fluid more or less viscid; and Mr. Benjamin Bell states this to be frequently the nature of the disease. "These cells," says Baillie, "vary in their size in different parts of the same gland, and in different swellings of the same kind in different individuals. Some of them are so large as to be able to contain a small pea, but most of them are of a smaller size. The viscid fluid, when the gland has been preserved some time in spirits, is changed into a transparent jelly. From this account of the morbid change of structure which takes place in bronchocele, it seems not unreasonable to suppose that the swelling depends upon a vitiated and increased secretion in the gland. The secretion, being in large quantity, gradually distends the cells, increasing thereby their capacity, and this enlargement of the cells forms the general swelling of the gland, (Morbid Anatomy, 8vo., pp. 87, 88.) The tumour is sometimes steatomatous. It is rarely found to contain purulent matter. Occasionally it has been in part converted into cartilage or bone. Dr. Hedenus, of Dresden, states that he has almost uniformly found this to be the case, (*Graefe's* Journ. der Chir. b. ii. Berlin.) Sometimes the enlargement of the gland is a true sarcoma. Dr. Mason Good names it *sarcoma cellulosum*, or cystose tumour, and states that it generally consists of "oval cells, currant-sized or grape-sized, containing a serous fluid, sometimes caseous," (Study of Medicine, vol. v.) Celsus has briefly and accurately described the appearances on dissection in these words: "Modo caro hebes, modo humor aliquis, melli aquæve similis, includitur; interdum etiam minutis ossibus pili immisti," (Lib. vii., cap. 13.)

[Occasionally, the whole organ is transformed into an osseous capsule, filled with various kinds of matter, especially the jelly-like, the suety, and the meliceric. Dr. Gross (*Elements of Pathological Anatomy*, p. 16: Boston, 1839,) states, that he has a specimen of the kind in his cabinet: one of the lobes has almost disappeared; the other is converted into a firm, solid capsule, as hard as bone, though scarcely a line in thickness. On sawing through this osseous tumour, which does not exceed the volume of a hen's egg, he found it filled with a white, lardy, friable substance, not unlike semi-concrete cheese.]

There have been instances in which the tumour has exhibited a complication of almost every diversity of structure. De Haen relates a striking example of this, in a person who died of dropsy from visceral tumours. "In cadavere horrendam mole thyroidæam glandulam nactus, publice dissecui. Mecum auditores mirabantur nullum fere genus tumorum dari, quin in hac sola thyroidæa inveniretur. Hic enim steatoma, ibi atheroma, alio in loco purulentus tumor, in alio hydatrius, in alio erat coagulatus sanguis, fluidus fere in alio, imo hinc glutine loculus plenus erat, alibi calce cum sebo mista," &c., (Rat. Medendi, pars vii. p. 285.) These circumstances countenance the opinion that the same causes may produce most of the different kinds of tumour, the modifications depending upon the difference of site, habit of body, idiosyncrasy, &c.

There are some other diseases with which bronchocele might be confounded, and which have indeed at times been included under the same name. Thus, the thyroid gland is occasionally attacked with acute inflammation, though, perhaps, less liable to it than most other glands of the body. In such cases, however, the swelling is more rapid in its progress than in bronchocele, but does not attain so large a size: it is firmer to the touch, painful on pressure, and the disease is much more liable to terminate in suppuration. Again, schirrus of the gland may be distinguished from goître by its great hardness, by occasional darting pains in the part, and by its generally occurring in advanced age, and seldom attaining to any great size. Alibert, however, states that he has seen an instance of true goître terminating in cancer. (Nosologie Naturelle.) Aneurisms, though they do not frequently occur in that situation, might possibly be mistaken for bronchocele; but they may be distinguished by their sudden appearance after violent exertion, particularly in coughing or laughing, by their being soft and compressible, by their situation directly in the course of the carotid arteries, and by their strong pulsation. The lymphatic glands are sometimes so enlarged, in scrofulous cases, as to form tumours of considerable size in the course of the trachea; they may, however, be distinguished from this disease by their greater tenderness on pressure, sometimes by an evident sense of fluctuation, by their being accompanied with swellings in other parts, and by the state of the general health. In some instances, indeed, the thyroid gland has, on dissection, been found in a natural state, the whole of the tumour consisting of a diseased state of the lymphatic glands and cellular membrane surrounding it. Instances have occurred of tumours arising in consequence of the lining membrane of the trachea being forced out between the cartilages in violent fits of coughing, sneezing, laughing, or other exertions of the lungs. Cases of this kind are styled the *real bronchocele* by M. Larrey. They might, perhaps, with more propriety, be called *hernia gutturis* or *hernia bronchialis*, names which have been sometimes given to the common bronchocele. Certainly, however, this is not the disease which has been usually known by the name of bronchocele, and to which the term is now almost universally confined; and as we are not at present considering the nosological propriety of the designation, we would include such cases among the spurious goîtres. Their most characteristic symptom is the complete disappearance of the tumour when compressed. The voice, too, is almost entirely lost, and the respiration performed with the mouth wide open. Larrey observed it most frequently among the blind people who are employed by the priests to chaunt at the tops of the minarets in Egypt; and he met with two cases of it in subaltern officers, who had for a considerable time been employed as military instructors. (Medical Gazette, vol. vii. p. 88.) Dr. Barton, in his memoir on goître as it prevails in America, states, on the authority of Foderé, that air has sometimes been forced, in like manner, into the substance of the thyroid gland and the surrounding cellular membrane. (Medico-Chirurg. Trans. vol. xi. p. 242.) Whether this be so or not, it appears certain, from the statement of various authors, that the tumour is often increased on exertion of the lungs. Goître may also be confounded with encysted tumours situated in the course of the trachea. The latter, however, are generally rounder, more moveable, more elastic, and more equal to the touch: they are sometimes diaphanous, and fluctuation may often be perceived on pressure. The period of life, too, may at times assist in the diagnosis. In addition to these spurious or complicated cases of bronchocele, there are other instances in which the gland itself is healthy, and the tumour consists of condensed cellular membrane, sometimes interspersed with cysts. Sometimes a cyst, filled with matter of a pultaceous or purulent nature, has been formed around the gland; and there have been cases in which the enlarged gland was surrounded by a yellow fatty mass.

We are so completely unacquainted with the uses of the thyroid gland, and consequently with the peculiar causes of disease in it, that it is not wonderful, perhaps, that there should have been so much conjecture and discordance of opinion with respect to the origin of bronchocele. Whatever may be the primary source of the disease, there is much reason for supposing that, once established, it is often continued in families by inheritance;* or, at least, that a strong predisposition to it is in this manner acquired. Thus we have known a woman with goître, whose grandmother, father, paternal aunt, and cousins, also had it; although they did not all live in the same place, and no other person in their neighbourhood was affected with the disease. Similar instances have presented themselves to others; (*Thomas's* Practice of Physic, p. 573, 2d ed.,) and it is well known that where cretinism prevails, infants are often born with goître. In such places, therefore, the effect of intermarriage among the inhabitants is not to be overlooked, as tending to spread and perpetuate it. The disease has sometimes been attributed to a scrofulous taint in the constitution; but as it is only met with in particular districts, as it is not always accompanied with swelled lymphatic glands or disordered general health, and as the tumour in bronchocele is scarcely known to suppurate spontaneously, while, on dissection, it has mostly been found of a totally different nature from strumous swellings, the conjecture must be abandoned. It has been held by some that bronchocele arises from a deficiency of nutritive food; and Dr. Mason Good countenances this opinion. He states, that on a visit to Derbyshire "he found a much larger number of the poor affected with this disease than he had ever seen before, while the rich escaped; and he found, also, that by far the greater part of those who were labouring under it were not only exposed to all the ordinary evils of poverty, but derived their chief diet from that indigestible and innutritive substance the Derbyshire *oaten cake*, which," he adds, "is probably the chief cause of all the glandular and parabysmic enlargements which are so common in that quarter." (Study of Medicine, vol. v. p. 416.) That insufficient nutriment may concur with other causes in producing the disease, is probable enough; but that this is its principal origin is an untenable idea; since, in countries where the malady prevails endemically, the rich are by no means exempt from it. There are other circumstances besides diet, too, capable, it may be, of producing it, and to which the poor are more exposed than the rich, as we shall presently show. And lastly, the oaten diet, to which Dr. Good attributes the disease in Derbyshire, is still more exclusively used in Scotland, where the disease is of rare occurrence.

It was long supposed, from goître prevailing so generally in mountainous countries, that it arose from the habitual drinking of snow-water. This notion seems to have been derived from Pliny,

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* Dr. [Sir] *James Clark*. Notes on Climate, Diseases, &c. in France, Italy, and Switzerland, p. 109, London, 1820.

(Lib. ii. cap. 37,) and copied by succeeding writers, because it tallied with their doctrines of cold and crude matters. When it is considered, however, that no such cause exists where the disease prevails in this country; that it is rare in Scotland, though common in many parts of the south of England; that the Swiss, who live contiguous to the glaciers, and drink no other water but what flows from the melting of ice and snow, are free from the disorder; and that it is never met with in Greenland, where snow-water is the common drink; while in Sumatra, where snow is never seen, it is of frequent occurrence; it is evident that we must look for some other cause. Dr. Richardson, indeed, in his journey with Capt. Franklin to the shores of the Polar Sea, ascertained that at Edmonstone, where, it seems, a residence of a single year is sufficient to render a family bronchocelous, the disease is seldom met with in those who drink melted snow, but is almost exclusively confined to those who use the river water. (Franklin's Narrative, &c. pp. 118, 119.) This circumstance, on the other hand, countenances the opinion that goître arises from certain calcareous or other impregnations of the water in common drink. The same view is strongly favoured by Dr. Bally, a native of a goitrous district in Switzerland. He says, "Bronchocele appears to me to be produced by certain waters which issue from the hollows of rocks, trickle along the cliffs of mountains, or spring from the bowels of the earth. That this is the case I may instance some fountains in my own country, (Département du Leman au Hameau de Thuet,) the use of whose waters will, in eight or ten days, produce or augment goîtrous swellings. Such of the inhabitants of the above village as avoid these waters are free from goître and cretinism." (Dict. des Sciences Médicales, t. viii.)

Dr. Coindet states that the use of hard water, or the pump-water of the lower streets of Geneva, brings on the goître very speedily, (Observations on the remarkable effects of iodine, &c. p. 7;) and Dr. Manson attributes the prevalence of the disease in Nottingham to the same cause. (Medical Researches on the effects of iodine, pp. 4, 5, 8vo. London, 1825.) The frequency, also, of its occurrence in the valleys of the chalky districts in Hants and Sussex is certainly in favour of these views. In the central parts of Hampshire, however, we have almost uniformly met with it in the valleys only; and even there its frequency is by no means so great as, in our opinion, to justify the conclusion that it arises solely from the nature of the waters. That it should prevail to a far greater extent in these vales than in many much more confined valleys in the more northern parts of the island, may possibly arise from the greater moisture of the soil where the substratum is chalk: and partly, perhaps, from the greater degree of miasmatic evaporation occurring under a more southern sun.

[A modern writer on bronchocele, Dr. Inglis, (*Treatise on English Bronchocele*, London, 1838,) affirms, that the presence of magnesian limestone always implies the co-existence of the disease; and Mr. M'Clelland, who had numerous opportunities for observation in India, (*Some Inquiries in the Province of Kemaon relative to Geology,* &c., Calcutta, 1835; cited in *British and Foreign Medical Review*, for July 1839, p. 103,) states, that in the course of his professional inquiries, which extended over 1000 square miles, and were prosecuted without any regard to theory, no instance occurred, in which goître prevailed to any extent, where the villages were not situate on or close to limestone rocks. Still, there are many places, as the Vallais, in which there are no limestone formations; and in other places, where the disease prevails, the water contains no calcareous salts.]

Whether or not the disease be necessarily connected with the impregnations of the water in those places where it prevails, every circumstance in its history tends to prove almost beyond a doubt, that it is induced by the agency of some one or more physical causes upon the constitution. Larrey observed that almost all the inhabitants in the valley of Maurienne were affected with goîtres, (Mém. de Chir. Mil. t. i. p. 123;) and Postiglione remarks that, in Savoy, Switzerland, the Tyrol, and Carinthia, there are villages in which all the inhabitants, without exception, have these swellings; the form and position of which are considered as indications of beauty. (Memoria sulla natura del gozzo, p. 22.) Professor Foderé, in his journey to the maritime Alps, made numerous observations in proof of its being a disease of low and moist regions. In the chief village of the valley La Roja, which is situated on high ground, there is not a goitre to be seen, though it is very prevalent in the immediate neighbourhood, which is comparatively low. He found, indeed, that all elevated regions, and all dry situations, whether warm or cold, were exempt from the disease; and he conceives that, throughout all climates, it takes its rise from the same cause —the humidity of the valleys. Dr. [Sir James] Clark, in his "Notes on Climate, Diseases, &c. in France, Italy, and Switzerland," states that he agrees in most respects with Foderé as to the origin of goître, and expresses his opinion, that it is probable, if the villages situate in the low, close, marshy situations of the Vallais, were destroyed, and the inhabitants removed to elevated, dry situations, cretinism and goître, which he believes to arise from different degrees of the same cause, would disappear. Dr. Gibson, also, in the first number of the Philadelphia Journal for the Medical and Physical Sciences, has collected a great number of facts leading to the same conclusion.

It appears from his statement, that bronchocele may be found as an endemic disease in all mountainous and marshy districts of the United States; that it generally prevails in valleys at the bottom of the highest mountains, in the neighbourhood of rivers, falls, lakes, or of the sea, and where the soil is rich and sheltered. Dr. James Johnson, in his Excursion through France, Switzerland, and Italy, recently published, has some excellent remarks on the physical causes of bronchocele and cretinism in the valley of the Rhone, drawn from his own personal observation. "Were this valley beneath a tropical sun," says he, "it would be the seat of pestilence and death. As it is, the air must necessarily be bad; for the high ridges of mountains, which rise like walls on the north and south sides, prevent a free ventilation; while in summer a powerful sun beats down into the valley, rendering it a complete focus of heat, and extricating from vegetation and humidity a prodigious quantity of malaria. In winter, the high southern ridge shuts out the rays of a feeble sun, except for a few hours in the middle of the day; so that the atmosphere is not sufficiently agitated at any season of the year. To this must be added the badness of the waters, which, along the banks of the Upper Rhone are superlatively disgusting." In farther allusion to the same subject, he states that, "it is remarked that cretinism is bounded to certain altitudes above the level of the sea. The Vallais itself, and the ravines or gorges of the mountains by which it is enclosed, are the chief seats of this deformity. All, or almost all, those who inhabit the higher ranges of the mountains overlooking the valleys, are exempt from the malady. This single fact proves that cretinism is owing to a physical rather than a moral cause, or series of causes. There can be no material difference in the moral habits of peasants residing at the base and on the brow of the same mountain. If the former be more subject to goître and cretinism than the latter, it must be owing to something in the air they breathe, the water they drink, or the emanations from the soil on which they reside. Saussure, Ferrus, Georget, and all those who have personal knowledge on the subject, acknowledge that at a certain height (five or six hundred toises) among the Alps, goître and cretinism disappear." "In short, we find in the Vallais, and in the lower gorges or ravines that open on its sides, both cretinism and bronchocele in the most intense degrees; as we ascend the neighbouring mountains, cretinism disappears, and goître only is observed; and when we get to a certain altitude, both maladies vanish." (pp. 56 to 58.) We believe that careful observation of the circumstances under which bronchocele is found to prevail in certain districts of our own country would lead to similar views respecting its origin; and in this manner may be explained the fact, that with us it almost exclusively affects the lower orders, who are of necessity the most exposed to such causes, and to those concurrent circumstances which poverty and ignorance entail upon them. Dr. Reeve, who visited the Vallais in 1805, for the purpose of making personal observations on the causes of goître and cretinism, remarks that "all the cretins he saw were in adjoining houses in the little village called La Batia, situated in a narrow corner of the valley: the houses being built up under ledges of the rocks, and all of them very filthy, very close, very hot, and miserable habitations. In villages situated higher up the mountains, no cretins are to be seen." (Edin. Med. and Surg. Journ. vol. v. p. 33.) It would be wrong, however, to pass over the observations of the celebrated Humboldt, which certainly tend to throw some doubt upon these views. He observes that, in South America, bronchocele is met with both in the upper and the lower course of the Magdalen river, and on the flat high country of Bogota, 6000 feet above the bed of the river. The first of these regions is a thick forest, while the second and third present a soil destitute of vegetation. The first and third are exceedingly damp, the second peculiarly dry. In the first the air is stagnant, in the second and third the winds are impetuous. In the two first the thermometer keeps up all the year between 22° and 23° of the centigrade scale; in the third it ranges between 4° and 17°. The waters drunk by the inhabitants of Mariguita, where goîtres are the most hideous, are not those of snow, but of springs which flow over granite. He states, also, that the disease is progressively extending itself from the lower provinces to the flat elevated regions of the Cordilleras. (Journ. de Physiologie, par F. Magendie, t. iii. p. 116.)

Ramond, likewise, in his observations on the Pyrenées, informs us that cretinism and goitre exist among these mountains even in greater extent and degree than in the Vallais, and under circumstances of locality very different; namely, in open, well-watered, and well-ventilated valleys. Upon the whole, therefore, we are scarcely warranted by facts in considering that bronchocele has its origin in any one exclusive source; though, as we have already stated, we think it probable that most frequently it is the offspring of a close, stagnant atmosphere, impregnated with moisture and the effluvia of the subjacent soil.

[There is something, at present, inscrutable in the character of the locality which gives occasion to the disease; and in reality we seem to know no more of the immediate cause of this endemic than of that of endemic diseases in general. (See the writer's *Practice of Medicine*, 2d edit. i. 557: Philad. 1844.)]

As bronchocele arises without our being able to trace with certainty its cause, so does it often unexpectedly disappear without any assignable reason, even after resisting all the approved remedies. This has frequently occurred under a change of residence, a circumstance which favours the view that we have considered the most probable respecting the origin of the disease. Alibert states that he has known many ladies in whom the tumour has subsided after a residence of some time in Paris. (Nosologie Naturelle, t. i. p. 473.)

Treatment.—A variety of means have been employed for its cure, both of a local and general nature. The former used to consist of dry rubbing the part; bathing it with cold water; friction with stimulating lotions, liniments, or ointments; mercurial applications, leeches, and blisters, kept open or repeated. Electricity also has been employed, and latterly galvanism, it is said, with some success.

Of the internal remedies, till within these few years, the most celebrated was burnt sponge. This was generally exhibited in doses of ten grains to half a drachm, three times a day, in the form of an electuary, infused in wine, or made into a lozenge, which was kept under the tongue till dissolved, from an idea that, in this manner, its influence was more direct and speedy. It was usual, however, to accompany this remedy with alterative medicines and purgatives, chiefly mercurial; and although we believe the efficacy of burnt sponge, when unadulterated,* to be undeniable, it in the 10th volume of the Medico-Chirurgical Transactions; and the operation has since been frequently performed in England. Some cases are published in the 11th volume of the Medico-Chirurgical Transactions, and in the 90th number of the London Medical Repository; from which it will appear that the operation is not so uniformly successful and free from danger as Dr. Quadri found it to be. Alibert mentions a case in which a seton produced a partial diminution of the swelling; but two years after it was withdrawn, the tumour became painful, suppurated, fifteen pints of matter were discharged, and six ounces daily for three months after; yet, notwithstanding, the disease was only partially removed. (Nosologie Naturelle, t. i. p. 466.) That the success or failure of this remedy is in some measure dependent upon the nature of the swelling is extremely probable, but from what specific difference in that respect the difference of effect may arise we are as yet entirely ignorant. Dr. Quadri states that he has passed a seton sixteen times in as many different directions through the tumour without any untoward accident. In one instance, endeavouring to perforate it pretty deeply, an unusual quantity of blood flowed from the wound, perhaps more than an ounce; and the tumour seemed to swell, as if injected with blood; but the bleeding ceased spontaneously, and he states his conviction, that unless the needle were pushed deep enough almost to touch the scutiform cartilage, the principal trunks of the thyroid arteries would not be injured. He states, also, that the consecutive inflammation is of trifling consequence. When we consider, however, that the blood-vessels of the tumours are frequently very much enlarged, there may, without doubt, be occasional risk of hemorrhagy. In two out of the four cases in the 11th volume of the Medico-Chirurgical Transactions, hemorrhage did occur, though not to an alarming extent; and Mr. Samuel Cooper states that fatal hemorrhages have sometimes followed the operation. (Good's Study of Medicine, vol. v. p. 322.—*Note.*) It must be admitted, also, that active inflammation excited so near to the trachea may often induce dangerous consequences, especially when the tumour is attached to that part. In one of the cases related in the Medico-Chirurgical Transactions, a patient of Mr. Gunning's, in St. George's Hospital, the operation was followed by fatal sloughing, and there was some appearance of inflammation on the lining membrane of the trachea. In another case, related by Mr. James, of Exeter, which, however, was ultimately cured, there occurred expectoration of purulent matter and lymph, a great degree of orthopnœa, suppressed voice, as in laryngitis, and threatening death, until the seton was removed. Dr. Hedenus, of Dresden, informs us that he has seen a patient die of tetanus after the operation. From our own experience, indeed, as well as that of others in this country, we should say that it ought only to be attempted when symptoms urgently demand it. We have, it is true, seen it at times produce but few unpleasant symptoms, though we have witnessed at other times serious consequences from it; so, also, we have seen both successful and unsuccessful cases with regard to the ultimate cure. Of the former, a case has been reported in the Medico-Chirurgical Review, vol. vii. 1827, treated by Mr. Henry Lyford, of the Hants County Hospital. The tumour, which was of four or five years' growth, and easily moveable, but unusually hard, almost entirely disappeared in less than two months. Dr. Quadri states that it is expedient to retain the seton in the tumour for a considerable length of time, in order to keep up the suppuration, until a cure is accomplished, as well as to prevent the formation of sinuses. When the suppuration ceases, and the wounds are perfectly healed, he has observed the curative process to go on in some cases until the goître is entirely dissipated. The skin which covered the swelling remains corrugated a short time after the cure, but soon resumes its natural appearance; and the cicatrices left by the seton in a few months present hardly any deformity.

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* It is stated by Dr. W. Gairdner, that chemists are in the habit of substituting charcoal for burnt sponge, of which an undeniable proof is the fact, that it is sold at a less price than unburnt sponge can be bought for. In this manner Dr. Gairdner explains the inefficacy of this medicine in the hands of British practitioners, whilst its

With the view of cutting off the supply of blood by which the tumour is fed, the thyroideal arteries have been tied, and the disease, in some instances, removed by thus destroying the balance between absorption and deposition. Dr. Quadri, indeed, suggests that the effect may have been obtained simply from the increase of absorption, occasioned by the irritation of the ligature, and from the inflammation and suppuration consequent upon the operation.—(Medico-Chirurg. Transact. vol. x. p. 26.) But we cannot conceive that such causes are sufficient to account for so disproportioned an effect. The experiment, we believe, was first attempted by Sir William Blizzard, and he succeeded in reducing the size of the swelling one-third in the course of a week; but the ligatures having then sloughed off, repeated bleedings took place from the arteries, hospital-gangrene ensued, and the patient was lost. From the circumstances of the case, however, the same event was by no means to be necessarily expected from the operation. Accordingly, in 1814, Professor Walther of Landschut repeated the operation in a case of that particular species of bronchocele which he calls the aneurismal. The patient was a young man, in whom the respiration was much impeded by the swelling, and the upper thyroid arteries were large and pulsated strongly. The left thyroid artery being tied, on the third day after the part of the tumour on that side became less tense, and the throbbing soon ceased. It continued to diminish gradually, becoming at the same time harder, and, as it were, cartilaginous. No febrile symptoms followed the operation, and the wound was completely healed on the twenty-third day. At the end of a fortnight, the left side of the swelling having diminished one-third, the Professor tied the right superior thyroid artery, with a like freedom from any unpleasant consequences. The right portion of the tumour also began to diminish; but, though originally smaller than the left, it did not waste away so completely as the latter, which at last was only one-third of its original size. Two years after, the remains of the tumour produced no inconvenience.—(Neue Heilart des Kropfes, &c. 8vo. Sulbach, 1817.) Another operation of the same kind was performed by Walther in 1820, and with still more complete success. In this patient, also, the tumour was tense, hard towards its centre, and pulsated strongly. The face was pale and tumefied, the respiration obstructed, and deglutition extremely impeded. On exposing the left superior thyroideal artery, it was found dilated so much as to surpass the diameter of a common quill. After it was tied, it became considerably contracted below the ligature, and ceased to pulsate. At the end of seven weeks the wound was entirely cicatrised; deglutition and respiration were performed without any difficulty; the tumefaction of the face had disappeared; the left half of the tumour, originally much larger than the right, was reduced to its natural size; and the patient left the hospital cured.—(London Medical Repository. October, 1822.) The first apparently successful case of the operation in this country that we are acquainted with, was that of Mr. H. Coates, of Salisbury, published in the 10th volume of the Medico-Chirurgical Transactions. The patient was a young woman, in whom the tumour was so large as to render respiration and deglutition extremely difficult, and causing a noise in breathing, which might be heard at a considerable distance. The superior thyroideal arteries were large and pulsated strongly. The left of these vessels was taken up. On the next day there was headach, and some swelling of the neck and side of the head; but these gave way to the abstraction of blood, and in three days all unpleasant symptoms vanished. The wound was completely healed on the fourteenth day. The patient's breathing was much improved, the size of the tumour being reduced nearly one-half; and in less than seven weeks from the operation she was discharged from the hospital quite well. In consequence, however, of an application we made to Mr. Coates for information as to the *final* result of the operation, we are authorized to state that, though the case proceeded extremely well for some time after the patient was discharged and lost sight of, yet the tumour subsequently, he understands, enlarged, and in the end destroyed her by suffocation. Mr. Coates states that he has not repeated the operation in any other case, nor should he be disposed to do so from the result in this instance. Mr. W. J. Wickham, of Winchester, has furnished us with the following notes of a case, in which one of the thyroid arteries was tied, in the Hampshire County Hospital, the operation being followed in like manner by apparent success at first, and failure in the end. He says, "It was the largest bronchocele I ever witnessed, but of the exact measurement I have no memorandum. After the ligature of the artery, the swelling gradually diminished for about six weeks, after which it as gradually regained its former size. It seemed that the decrease of the tumour continued so long as the part of the gland, which had been supplied by the vessel, remained without nourishment; but as soon as the supply was restored by the anastomosing branches from the opposite superior and the two inferior thyroideal arteries, the swelling returned to its former dimensions. Such, I should conceive, would be the case, unless all the thyroideal arteries were obliterated, which it would be a very difficult task to accomplish, if not altogether impracticable, from the depth of the lower vessels. In this case, after the foregoing operation, I introduced a seton through the gland, which was succeeded, at first, by great tumefaction of the part and alarming difficulty of breathing, but produced afterwards a slight diminution of the swelling. After a few weeks, however, it was necessary to withdraw the seton in consequence of its having occasioned great constitutional disturbance, and ultimately no benefit at all was derived from it. The result of the case, indeed, does not give me much encouragement to attempt a repetition of either plan of treatment on another occasion." Mr. Samuel Cooper mentions, in his Surgical Dictionary, that Mr. [Sir B.] Brodie performed the operation in one case without producing any material diminution of the tumour. Mr. H. Earle, however, has been more successful. He has published the result of a case, in which he tied both the superior thyroideal arteries, with great advantage, though not with the effect of completely dissipating the tumour. The patient was a girl of seventeen, in whom the gland was very painful, and so large as greatly to impede respiration and deglutition. Her general health was bad; she suffered much from pain in the head and drowsiness, and complained of pain in her chest, and cough, with foul tongue, and rapid pulse. As the disease did not yield to the usual remedies, she was sent back into the country on account of her general health, but returned some months afterwards with the goître increased, so as to produce extreme dyspnœa, and totally prevent her from swallowing solid food. The pulmonary affection continued; there was constant headach and drowsiness, and the pulse was 120. As the disease still resisted medicine, and threatened fatal consequences, the operation was determined upon. The right superior thyroid artery was found to be enlarged to the size of the carotid. On tying it, there succeeded intense headach and increased drowsiness, which were subdued by a full bleeding from the arm, leeches to the temples, purgatives, and digitalis. In a few days the tumour was found to be diminished, respiration and deglutition were much less impeded, and the cough had nearly left her. Within a month she was sent home; the circumference of the swelling being diminished three inches and a half. A fortnight afterwards, the tumour remaining stationary, she returned, to have the artery on the left side tied. This was found of the size of the radial artery. No urgent symptoms followed from its being taken up; but the diminution of the tumour was not nearly so great or so rapid as after the former operation. In a month the patient finally left the hospital, with no impediment in swallowing or respiration, and free from cough, the tumour being much softer and smaller. Three months after the operation it was continuing slowly to decrease.—(Med. and Physic. Journ. vol. lvi. p. 201, & seq.) From all that we yet know of this operation, we may conclude that it may be performed, perhaps in most cases, with safety; but that it is advisable in all instances of bronchocele is much more than doubtful. It appears not to have been uniformly successful even in reducing the tumour; still less in the complete removal of it. When it is considered, indeed, how largely the thyroid gland is supplied with blood, having four considerable arteries assigned to it; and how soon the place of obliterated trunks is supplied by the collateral branches; the occasional failure of the operation is not surprising, and the permanency of its benefit, even in apparently successful cases, may sometimes, as we have seen, be questionable. When the urgency of symptoms, however, demands it, and more particularly when the tumour is of a pulsating nature, a dexterous surgeon may probably adopt this with as much safety and prospect of success as any other surgical means of relief.

In some instances the goitrous tumour has been removed, at once, by excision. This, however, will appear to be a most hazardous undertaking, when we consider the number and magnitude of the bloodvessels, and the important nerves adjacent to the tumour, with which it is generally involved; the impossibility of using much pressure in such a situation for restraining hemorrhage; and the risk of wounding the trachea and œsophagus, to which the deceased mass is often adherent. Possibly the removal of the tumour at an early stage of its progress might not be attended with very serious danger. Mr. J. Baillie Fraser tells us, he was informed in his tour through the Himala mountains, that goitre, which prevails in the valleys there, was sometimes cured when early means were taken, and that these consisted in extirpation of the part by the knife. He adds that he saw some persons with the scars from the operation on their throats, and that, in these instances, the cure was complete. (Journal of a Tour through the Himala Mountains, p. 349. 4to. London, 1820.) In 1791, Dessault extirpated a tumour of the right portion of the thyroid gland, which was five inches in circumference, and proved to be similar in all respects to scirrhous glands, except that in the centre there was a cartilaginous nucleus. In this case there were no very untoward circumstances, and the patient was dismissed cured on the thirty-fourth day after the operation. (Dessault's Parisian Chir. Journ. vol. ii.) The difficulties and danger, however, attending the operation, when the tumour is large, of long standing, and has formed extensive adhesions, are very great. Mr. Gooch relates two cases in which he attempted this mode of cure. In the first he was compelled to desist, before the operation was half completed, in consequence of profuse hemorrhage, which no means were able to stop; and the patient died in less than a week. The second had nearly ended fatally, also, from loss of blood, this dexterous operator being completely foiled in his attempts to stop the hemorrhagy by ligatures. The patient's life was only saved by having a succession of persons to keep up a constant pressure upon the bleeding vessels, by means of their fingers, or proper compresses, day and night, for nearly a week. (Gooch's Medical and Chirurgical Observations, p. 136.) The operation has been fatal, also, apparently from injury to some of the important nerves in the vicinity of the disease. A woman on whom Dupuytren operated, without losing more than a few ounces of blood, was seized with hurried respiration, sickness, coldness of skin, &c., and died soon after the excision. The operation, however, has accomplished a cure, in some instances even of the most aggravated description. Vogel and Theden performed it with success. Professor Graëfe, of Berlin, succeeded in a case where the tumour was so large that he thought it advisable to perform the operation by instalments, cutting off one side of the gland first, and, after waiting till the wound was healed, removing the other. In the course of the operation he took up fifty arteries. (Lawrence's Lectures; Medical Gazette, vol. vi. p. 719.) But of all who have attempted excision in bronchocele, Dr. Hedenus, of Dresden, has been the most fortunate. It appears that he has performed it six times with success. In one instance the circumference of the tumour was fourteen inches. The operation lasted an hour and a half. Some hours after, there commenced a considerable oozing of blood from all the wounded surface, which it required assiduous care to suppress. After the separation of the ligatures, on the eighth day, there was a considerable hemorrhagy, and on the eighteenth day a more serious one occurred in consequence of a convulsive cough. The patient lost two pounds of blood; there was a deadly paleness over his whole body, dimness of sight, loss of speech and hearing, and extreme faintness. By judicious treatment, however, his life was preserved, and he was, at last, dismissed cured. (Graefe's Journ. der Chir. B. ii. p. 237. Berlin, 1822; or Quarterly Journal of Foreign Medicine. No. 19, p. 317.) A case was published some years ago, in which Klein removed a very large bronchocele, but the patient died upon the operating table. (Journ. der Chir. B. i. p. 120.—Journ. of Foreign Medicine, vol. ii. p. 380.) In short, judging from the results of the operation, even in the hands of the most judicious and highly skilful surgeons, we may venture to state that it ought scarcely to be attempted when the tumour is of great magnitude, and adheres firmly to the neighbouring structures, and certainly, in no case, until all other means have failed.

Dr. [Sir James] Clark states that Mr. Major informed him of a case in which the tumour was successfully removed by ligature. In another, in which Mr. Major himself adopted that plan, the patient was lost in consequence of hemorrhagy, or rather, he sank from neglect of the attendant [illegible] ed from it. (Op. under the low fever which ensued. cit. p. 111.)

It should be kept in mind by the practitioner, that the removal or sudden subsidence of a bronchocele is sometimes followed by irregular action of the heart, or some other functional disturbance. [illegible]ptom.

ANDREW CR[illegible]

BRONCHORRHŒA. (See B[illegible] CHRONIC.)

BULLÆ, *blains*, an order of cut[illegible] eases characterized by an eruption of [illegible] vesicles, containing a serous or sero-pu[illegible] and succeeded by yellowish or blac[illegible] sometimes by ulcerations.

Syn. Φλύκταιναι, ἑλκώδεις φλυκταινίδες [illegible] (*Hippoc. et vet. Grec.*); Πομφόλυγες (*re*[illegible] Phlyctænæ, Ampullæ (*Auct. var.*); Bullæ [illegible] Dartre plyctenoide (*Alibert*); Bulles, A[illegible] Cloches (F.); Blasen (Germ.) *Blebs.*

Plenck was the first to found a class [illegible] form of eruption, for before his time th[illegible] distinguished by bullæ were comprehen[illegible] ther with all vesicular affections, unde[illegible] general term of phlyctænæ; but not [illegible] ous in the definition of his class, he [illegible] it phyma, a superficial collection of p[illegible] of paronychia, approaching nearly to the nature of furunculus. Willan had returned to the ancient classification which placed vesicles and bullæ in the same order, from which he was only induced to depart in deference to the well-founded criticism of Professor Tilesius, of Leipsic; and they who have seen much of vesicular eruptions will allow that the learned professor might have found reasons for his distinctions not less in the different nature of the constitutional affections than in their external appearances. But in correcting this error, Dr. Willan did not remove all the objections which might have been made to his arrangement; for, whilst on the one hand he retained, in the order of bullæ, erysipelas, of which vesications are only incidental phenomena, he excluded rupia, of which disease they form the proper elementary eruption. It is therefore our intention to follow M. Biett, in part of his reform of this classification, leaving pemphigus, pompholyx, and rupia to constitute the order of bullæ.

This elementary form of cutaneous eruption may be produced by external as well as internal causes; and hence bullæ are the ordinary effects of blisters, as of cantharides, ammonia, and many other acrid or rubefacient substances; hence they are caused by burns, scalds, and frost-bites, and are common consequences of friction, pressure, and of distension, as occurs in œdema. The poisons of some serpents are also said to give rise to eruption. But the bullæ arising from the foregoing causes, generally denominated vesications, we leave to our surgical brethren, reserving to ourselves those of spontaneous origin, which observe also a very different progress.

The formation of these last is generally preceded by an elevated erythematous spot, more or less of a bright colour, which, in a certain time, seldom exceeding forty-eight hours, is followed by a small vesicle, which gradually enlarges to a blain. The humour contained in the bulla is in general serous and transparent, but is sometimes sero-purulent, rarely sanguineous. At first the bulla is tense, and the humour may remain a long time accumulated under the epidermis; but it becomes afterwards flaccid, whilst the humour thickens, and often dries into solid scabs, more or less considerable. Or, if situated in a part where the epidermis is thin, the bulla bursts after a few days, and is followed by a thin scab, unless the surface be defended from the air by a portion of the detached cuticle, or any other covering, when it presents a white flocculent secreting covering. In either case the skin gradually provides itself with a new epidermis, or becomes the seat of an ulceration more or less deep.

Though the diseases of this order may exist as acute, they generally present themselves as chronic disorders, eruptions of bullæ following each other in regular succession. As chronic diseases they are never contagious, but generally connected with some disorder of the constitution or the internal organs; hence bullæ are symptomatic of a state of cachexy, of inflammation or irritation of the mucous membrane of the bronchi or the alimentary canal, or of derangements of the function of the liver. They are also observed incidentally in small-pox, the bulla *variolosa* of Plenck.

The pathological condition giving rise to this form of eruption consists, as far as has been ascertained, in an inflammation of the *rete mucosum*, or upper surface of the cutis, by which a more copious secretion of serous fluid takes place than can be transmitted by the cuticle, thus causing its separation and elevation. In proof of this we may mention that the *rete mucosum* remains adherent to the cutis, and is not detached with the cuticle, as happens when this latter is forcibly torn off. The inflammation which gives rise to the formation of bullæ may be also considered to exist in a higher degree than in erythema, for a higher degree of irritation converts erythema into bullæ.

As bullæ may be dependent upon such different states of the body, it is obvious that their treatment must be various; and therefore we may understand how, in some diseases of this order, the antiphlogistic regimen may be required, whilst, in others, alteratives or tonics may be most advisable, and how, in all the forms, great attention to regimen is always essential.

T. J. Todd.

[CACHEXIA, Cachexy, Cacochymy, Dyscrasy, literally means "bad habit;" from κακος, "bad," and ἕξις, "habit." It has, however, received different acceptations in the history of medicine, and been made to comprise various diseases, which are now more generally separated from it. The acceptation in which it is employed generally at the present day, and always by the author, (see his *Practice of Medicine*, 2d edit. ii. 611, Philad. 1844,) embraces chronic affections, which are induced by some *vice* in the system of nutrition, whether such vice be dependent upon a morbid condition of the circulating fluid that furnishes the pabulum whence the tissues are formed, of the vessels of nutrition themselves, or of both combined. This definition is analogous to, and less liable to objection than, that of Dr. Copland, (*Dict. of Practical Medicine*, art. Cachexy,) "Depravity of the constitution, without fever, affecting more or less the solids, the circulating fluids, and the secretions."

The chief morbid conditions that fall under cachexies, are scrofulosis, tuberculosis, scorbutus, chlorosis, rhachitis, hydrops, cancer, and syphilis; but with equal propriety we might class amongst them the morbid results of splenic disease, of lead poison, and many chronic cutaneous affections, in all of which the character of the circulating fluids, or the condition of the function of nutrition, or of both, is modified. In strictness, indeed, of definition, many other diseases might be placed in the same division, which, although seeming to affect primarily particular portions of the frame, implicate, sooner or later, the whole economy.

In order that the tissues shall be duly nourished, the blood must be possessed of appropriate qualities. Should it fail in these requisites, and impress the parts which it bathes abnormously, faulty nutrition must be the consequence. In like manner, if the blood be healthy, and the organs that are concerned in the nutrition of the tissues be morbidly impressed, disease must result; hence, hypertrophy or atrophy may be induced,—in which there may be simply an increased nutritive action in one case, and a diminution of it in another; or the nutritive action may, under special circumstances, become so much perverted, that substances may be formed and separated from the blood, which have nothing analogous to them in the economy. These last are cases which are considered by all to belong to cachexia. Under some inappreciable vice in the system, the nutrition of the tissues is so much perverted as to give occasion to various heterologous formations. In some cases, the altered condition of the blood gives rise to a train of phenomena indicating a paucity of fibrin and red globules. The blood is, consequently, imperfectly adapted for the nutrition of the tissues, whose tone is diminished, as indicated by the general appearance of the patient, and by an asthenic condition of all the functions. In other cases, the pravity of nutrition may be evinced by morbid conditions of the cutaneous envelope, or by chronic cutaneous diseases.

In regard to the diseases of the system of nutrition, which are dependent upon some morbific influence or *vice*, as scrofula, cancer, and syphilis, the great indications are much alike. The only mode by which the system can become dispossessed of the vice is by inducing a new condition, which is incompatible with its existence; hence, every effort is made to occasion a change in the circulating fluid by appropriate therapeutical and dietetic agents. These may thus produce a new action in the tissues which they bathe, and break in upon the morbid condition. With this view, recourse is had to those valuable eutrophics—as iodine and its various preparations—which are the gifts of modern chemistry. (*Practice of Medicine*, loc. cit.)

Robley Dunglison.]

[CÆCUM, DISEASES OF THE. (See Constipation.)]

CALCULI, (Chemical Composition [and Microscopic Appearance.)]—The term calculus is applied to any solid or unorganized concretions found in the human body. Such concretions have been found in almost all the mucous cavities and canals; in the lachrymal passages; in the mouth, for the tartar in the teeth is certainly of this nature; in the tonsils; in the salivary and pancreatic ducts; in the stomach; in the intestines; in the gall-bladder and biliary passages; in the ramifications of the bronchi; between the prepuce and glans; in the ducts of the mamma; in the vesiculæ seminales; in the ducts of the prostate gland, and in the urinary canals and bladder. Earthy concretions have also been found imbedded in the substance of the brain and other soft parts; within scrofulous abscesses; in cancerous cavities, and in hydatid cysts. The deposition of this earthy matter seems to take place around foreign bodies introduced into the animal frame, as the effect of the irritation which they cause, and probably as the means of rendering them less obnoxious to the living textures. Thus where an extra-uterine fœtus has been long retained, it is usually found more or less encrusted with earthy matter; and when musket-bullets or other projectiles have remained in the human body, their surfaces become covered with a coating of what appears to be phosphate of lime. Even the vascular system is not free from calculous concretions; and small indurated masses have been found within the cavities of veins, which have thence obtained the name of phlebolithes.

Chemical Composition of Calculi.—Calculous concretions were noticed by the ancients, and named, obviously from a notion that they were of a stony nature, λιϑια by the Greeks, and *calculi* by the Romans. Hippocrates describes the symptoms of calculus in the kidney and urinary bladder with his usual precision. Pliny enumerates a great number of remedies for this dreadful disease, and Celsus describes a method of extracting calculi from the bladder, which Heister praises as excellent. But we look in vain into the writings of the ancients for any description of calculi, or any examination of their nature.

The first person who attempted to speculate respecting them was Paracelsus, though it is somewhat difficult to form an accurate idea of the notions which he entertained on the subject. He seems to have thought that the calculus separates from the liquids of the living body in the same way that tartar is deposited from wine upon the sides and bottom of the wine-cask. This seems to have been the reason that induced him to give the name of tartar to calculi. This tartar, which is apt to be generated in the living body, was in Paracelsus's opinion the origin of most diseases. It differed in its qualities according to the nature of the liquid from which it was generated. He gave it the name of tartar, because it burns the patient like *hell-fire* in severe diseases. It is deposited when the archeus acts with too much impetuosity and irregularity, and when it separates the nutritive principle with too much activity. Then the *saline* spirit unites with the *earthy principle*, which always exists in the liquids, but in the state of *materia prima;* and this union occasions the formation of *tartar* or *calculus*.

The subject of *calculus* was taken up by Van Helmont, in his treatise *De Lithiasi*, which constitutes perhaps the most important and valuable part of all his works. He subjected various urinary calculi to a chemical investigation, and showed that they differed entirely in their nature from the *stony* bodies which occur in the mineral kingdom; from which he drew, as a consequence, that they did not originate from matter contained in food or drink. Tartar, he observed, was deposited from wine, not as an *earth*, but as a crystallized salt; and in the same way the natural salt of urine is precipitated to give origin to a calculus. This precipitation may be imitated by mixing spirit of urine (*solution of carbonate of ammonia*) with rectified spirit of wine. A white precipitate immediately falls, to which he gave the name of *ossa alba*. This view of the subject, which was to a certain extent just, induced Van Helmont to lay aside the name tartar, which had been employed by Paracelsus; and to avoid ambiguity, he employed the term *duelech*, to denote the state in which the spirit of urine is precipitated when it gives origin to calculous concretions. These views he endeavoured to confirm by an analysis of urine, which was as perfect as could be expected when the experiments were made, and certainly enabled him to approach much nearer the truth than any of his predecessors had done.

No attempt (so far as we know) was made to determine the nature of calculi, or to discover remedies capable of dissolving them in the bladder without injuring that organ, till the publication of the second volume of *Hales' Vegetable Statics*, in the year 1733. He exposed different calculi to a red heat in a gun-barrel, and found that they yielded a quantity of *air* amounting to above five hundred times their bulk — a greater quantity of air than most other animal or vegetable substances could be made to yield. This was a decisive proof (if any had been wanting after the experiments of Van Helmont) that urinary calculi are quite different in their nature from the stony bodies belonging to the mineral kingdom. Dr. Hales made several attempts to discover a solvent of urinary calculi, but it is unnecessary to relate them as they were not attended with success.

In the year 1743, Dr. Whytt published an essay to show that *lime-water* was a remedy for the stone. This essay first appeared in the Edinburgh Medical Essays, and was reprinted with them in 1747, and finally published separately in 1752. Soon afterwards Dr. Alston published *A Dissertation on Quicklime*, in which he deduces from his experience that lime-water may have a tendency to prevent the formation of calculi; but that it is incapable of dissolving them when once formed. As neither of these gentlemen made any experiments on the calculi themselves, their observations contributed very little towards improving our knowledge of the nature of these concretions. The analysis of calculi by Slare contributed but little to explain their nature, (Phil. Trans. vol. xvi. 140.) Boyle had subjected them to distillation, and had obtained an oil and a great quantity of carbonate of ammonia.

Such was the state of the chemical knowledge of calculi, when, in the year 1776, Scheele published a set of experiments upon urinary calculi in the Memoirs of the Stockholm Academy, (Untersökning om Bloss Stenen, p. 327.) He found all the calculi that he examined of the same nature. He could discover in them no sulphuric acid and no lime; but they consisted of a peculiar substance possessing acid properties, and characterized by dissolving with effervescence in nitric acid, and assuming a beautiful pink colour when the solution is evaporated to dryness without the application of too much heat. To this acid the name *lithic acid* was afterwards applied, which by Fourcroy was changed into *uric acid*, in consequence of a remark of Dr. Pearson. Scheele showed that all urine contains this acid. Hence the origin of urinary calculi came to be understood. Whatever has a tendency to throw down uric acid from urine may give origin to a calculus.

To this paper of Scheele an appendix was added by Bergman, in which he stated the result of his own experiments. He detected the uric acid which Scheele had discovered, but found also some lime in all the calculi which he examined. This important paper of Scheele constituted the first step, and it was a material one, towards a full investigation of the nature of urinary calculi.

Hardly any addition was made to the facts ascertained by Scheele and Bergman till the year 1797, when Dr. Wollaston published a paper *on gouty and urinary concretions*, in the Philosophical Transactions. In this paper he gave an account of three species of urinary calculi, quite different in their composition from those described by Scheele. The concretions which appear in the joints of gouty persons, and which had been known to medical men by the name of *chalk stones*, he ascertained to be a combination of *uric acid* and *soda*. To the three new species of calculi he gave the names of *fusible calculus*, *mulberry calculus*, and *bone-earth calculus*.

The *fusible calculi* had been first noticed by Mr. Smithson Tennant, who found, that when urged by the blow-pipe, instead of being nearly consumed, as happens to the uric acid calculi of Scheele and Bergman, they left a large proportion which fused into an opaque glass. This he conjectured to be phosphate of lime mixed with other phosphoric salts of urine. Dr. Wollaston found that this kind of calculus was white, and that it consisted partly of sparkling crystals composed of ammonia-phosphate of magnesia. These crystals had the form of short triangular prisms, having one angle a right one and the other two equal, and terminated by a pyramid of three or six sides. The other constituents of this calculus are phosphate of lime, and a very small quantity of uric acid.

The *mulberry calculus* had been noticed and named before by medical men; but no attempt had been made to determine its nature. The surface is irregular and knotted, bearing a distant resemblance to the mulberry. Dr. Wollaston showed that it is composed of oxalate of lime, mixed with a little blood and other animal matter. Calculi of the same nature are sometimes met with, smooth on the surface, and much lighter coloured. These, from their appearance, were called *hemp-seed* calculi, and were not suspected to be of the same nature with the mulberry, till Dr. Wollaston ascertained their composition.

The *bone-earth calculi* are of a brown colour, and so smooth as to appear polished; they consist of regular laminæ, easily separated from each other. Dr. Wollaston showed that they are composed of phosphate of lime: hence the name by which he distinguished them. Before the blow-pipe this calculus is slightly charred: it then becomes white; and when urged with the utmost heat from a common blow-pipe, it is at length fused. As this cannot be done with the earth of bones, Dr. Wollaston infers that the bone-earth calculi are composed of neutral phosphate of lime; whereas the earth of bones is known to be a subsesqui-phosphate of lime, or a compound of—

1 atom phosphoric acid	4.5
1½ atom lime	5.26
	9.75

Dr. Wollaston, in this important paper, also examined the calculi from the prostate gland, and found them composed of neutral phosphate of lime tinged with the secretion of the prostate gland.

Some years after, a set of experiments on urinary calculi was published by Fourcroy and Vauquelin. They examined no fewer than five hundred different calculi, and were thus enabled to add a little to the important discoveries of Dr. Wollaston, to which, however, they make no alluston in their paper. They found calculi composed of urate of ammonia; and in two different calculi they found a small quantity of silica. The animal matter which serves as a cement to the constituents of the calculus, they consider as sometimes consisting of albumen, and sometimes of urea; but it is evident from the way they speak of it that they had not subjected it to a rigid examination.

The next addition to the chemical knowledge of the nature of calculi was made by Dr. Wollaston in 1810, (On a new species of Urinary Calculus, Phil. Trans. 1810, p. 223); by the discovery of a urinary calculus composed entirely of a peculiar substance capable of combining equally with acids and alkalies, and which he distinguished by the name of *cystic oxide*. It is of rare occurrence; only about six or seven such calculi having been hitherto met with.

The labours of Austen, Walther, Brugnatelli, Pearson, Brande, &c., have not added many new facts to those already known; but Dr. Marcet, in his *Essay on the Chemical History and Medical Treatment of Calculous Disorders*, published in 1817, gives an account of two new species of calculi which he had observed. The first, which he received from Dr. Babington, weighed eight grains, and was composed of a substance to which Dr. Marcet gave the name of *xanthic oxide*, from the lemon yellow colour which it forms when acted upon by nitric acid. The other calculus was about the size of a pea, and the substance of which it was composed possessed the characters of *fibrin*. On that account Dr. Marcet gave it the name of *fibrinous calculus*.

In the year 1821, Dr. Prout published *An Inquiry into the Nature and Treatment of Gravel, Calculus, and other Diseases connected with a deranged Operation of the Urinary Organs*; a new and improved edition of which appeared in the year 1825. In this work he treats at large on urinary calculi, and the states of the urine connected with their formation; and has thrown more light upon the subject than any preceding writer.

Such is a short history of the principal discoveries respecting calculi, chiefly of the urinary organs We shall now take a view of the different calculi which are apt to form in living animals, and point out their nature, and the causes of their formation, so far as the subject has been investigated.

The calculi formed in living bodies are distinguished according to the organs in which they appear. We shall notice them in alphabetical order, dwelling principally on their chemical composition.

1. *Biliary* calculi, formed in the gall-bladder.
2. *Gouty concretions*, formed in the joints of gouty individuals.
3. *Intestinal concretions*, formed in the stomach and intestinal canal of man and the inferior animals.
4. Ossifications or concretions which occasionally form in the pineal gland, the salivary glands, the pancreas, the liver, the spleen, the lungs, &c.
5. Calculi formed in the prostate gland.
6. *Urinary* calculi, formed in the kidney or urinary bladder.

I. Biliary Calculi.—Hard bodies occasionally form in the gall-bladder, which, making their way into the duct through which the bile passes into the intestinal canal, prevent the bile from passing, and thus occasion the well-known disease called *jaundice*. These concretions have received the name of biliary calculi, or gall-stones. Though their existence was known to the ancients, and though they had been imperfectly described by medical men, scarcely any thing was known respecting their nature till they were examined by Poulletier de la Salle, about the year 1784, who found that they were partly dissolved by boiling alcohol, and that the alcohol on cooling deposited a number of brilliant white plates, bearing some resemblance to spermaceti. The subject was taken up by Fourcroy in 1785, who compared the matter of gall-stones to the fatty matter into which human bodies had been converted when left in great numbers, piled on each other, to spontaneous decomposition. To this substance he gave the name of *adipocire*; and the same name was applied by him to the chief constituent of gall-stone. In 1814, Chevreul showed that these notions of Fourcroy were inaccurate; that the substance discovered by Poulletier de la Salle in gall-stones was quite different from Fourcroy's adipocire. Chevreul gave it the name of *cholesterine* (*solid bile*), and showed that it existed as a constituent in bile. The biliary calculi hitherto described may be divided into three species, namely, *cholesterine* calculi, *mellitic* calculi, and calculi composed of *inspissated bile*.

1. **Cholesterine Calculi.**—These calculi are not by any means so abundant as those belonging to the second species, if we are to judge from the number which we have ourselves seen. They have a white colour, and a crystallized, shining, lamellated structure. Pretty frequently they have a slight shade of brown, sometimes indeed a decided brown colour, owing doubtless to the matter of bile interspersed through them, but in too small quantity to be visible to the eye, except by affecting the colour of the calculus. These calculi are composed of cholesterine, nearly in a state of purity. The largest we have seen was about the size of a hazel-nut, and very nearly spherical. It is exceedingly light, owing to the low specific gravity of cholesterine.

Cholesterine, when pure, has a white colour, and a silky or pearly lustre. It is lighter than water; it is tasteless and insoluble in water, and possesses little or no smell. Boiling alcohol dissolves about the fifth part of the weight of it, but deposits it on cooling in small brilliant plates. When heated to about 279° it melts, and in a vacuum it may be sublimed without decomposition. It does not combine with potash, nor can it be converted into a soap. According to the analysis of Chevreul, it is composed of—

1 atom oxygen............	1
37·5 atoms carbon..........	28·125
31·5 atoms hydrogen........	3·9375
	33·0625

But as it possesses neither acid nor alkaline characters, and is not known to combine in definite proportions with other bodies, we have no means of determining whether these numbers or some multiple of them constitute the true compositions of it.

2. **Mellitic Calculi.**—We have given this name to by far the most common species of biliary calculi; and we have named them from the colour, which bears a considerable resemblance to honey, only it is browner. These calculi have always a polygonal shape, occasioned by mutual pressure; for a number of them always exist in the gall-bladder together. We have taken six out of a gall-bladder after death, and the gall-bladder in that case was almost filled. Most commonly they have three blunt edges, and have some resemblance to two low tetrahedrons applied base to base, with their edges and angles rounded off. The mean specific gravity is about 1·061. Their outer surface is smooth, and has a soft feel. When broken, they exhibit a thin outer crust, composed of concentric layers crystallized in small rays inclining towards the centre. These crystals consist of cholesterine. The nucleus has usually the appearance of granulated honey, and consists of inspissated bile.

In the calculi of this species, which we have subjected to analysis, very nearly 19.20ths of the whole was cholesterine. The rest was a mixture of picromel and some other animal matter, which was too small in quantity to admit of a rigid examination.

3. **Inspissated Bile Calculi.**—This species has a yellow colour, contains little or no cholesterine, but is entirely composed of inspissated bile. So far as our observations go, it is much more uncommon than either of the other two. That it exists, however, there can be no doubt, as Thenard examined several biliary calculi belonging to this species. The gall-stones of oxen are usually of a yellow colour, and consist of the yellow matter of bile mixed with minute traces of bile, which may be separated by water. When thus washed, they are tasteless and insoluble in water and in alcohol. They are used by painters, though their colour is not permanent, but soon changes to a brown.

As all the constituents of biliary calculi exist in the bile, there is no difficulty in understanding how they may be deposited when the proportion of the constituents of that liquid undergoes alteration.

Cholesterine has been rarely found in biliary calculi of the inferior animals; but that it exists in them also is certain; for Lassaigne found the constituents of a biliary calculus from a sow which he examined, as follows:—

Cholesterine	6
White resin	44·95
Bile	3·60
Animal matter	45·45
	100.00[*]

II. **Gouty Calculi.**—It is well known that concretions occasionally make their appearance in joints long subject to gout. These concretions, from their colour and softness, have received the name of *chalk-stones*. They are usually small, though they have been observed of the size of an egg. Their nature was first discovered by Dr. Wollaston in 1797, who proved that they were combinations of uric acid and soda, or composed of *urate of soda*.

Gouty concretions are soft and friable. Cold water has little effect upon them; but boiling water dissolves a small portion. If an acid be added to this solution, crystals of uric acid are deposited on the sides of the vessel. They are completely soluble in caustic potash when the action of the alkali is assisted by heat. When they are treated with dilute sulphuric or muriatic acids, the soda is separated, while the uric acid remains, and may be obtained in a pure state by filtration and washing. When the liquid is evaporated, it yields crystals of sulphate of soda or of common salt, according to the acid used. When the uric acid thus obtained is distilled, it yields ammonia, prussic acid, and the acid sublimate of Scheele (*pyruric acid*). When dissolved in a little nitric acid, it tinges the skin of a rose colour, and, when evaporated, leaves a rose-coloured deliquescent residuum.

III. **Intestinal Calculi.**—Concretions of very considerable size are sometimes found lodged in the stomach and intestines; not so frequently in the human body, but very often in some of the inferior animals.

The only intestinal concretions from the human body which we have seen are in the collection of the late Dr. Monro, of Edinburgh, and may still be seen among the preparations belonging to the anatomical class in the University of Edinburgh. They amount to forty-one, and are all very nearly of the same nature, though they differ in size. There are fifteen calculi exactly similar in the collection of calculi made by Dr. Hunter, and now belonging to the University of Glasgow. The largest of these weighs 1057 grains, and as some parts of it are wanting, there can be little doubt that its weight, when entire, was at least 1100 grains. These calculi have a brown colour, and are composed of fibres interwoven together after the manner of felt. They have altogether a certain resemblance to sponge. They feel soft, but are too hard to be much compressed. The specific gravity is about 1·4. One of those in Dr. Hunter's collection has a fruit-stone for a nucleus. In most of those in Dr. Monro's collection no nucleus whatever can be observed. Dr. Monro used to mention, in his lectures, that these concretions had been found in the colon, and that they had all proved fatal. The principal constituent in these concretions is the felted fibrous matter, which was naturally supposed to have been derived from the food. Mr. Clift, of the College of Surgeons, London, conjectured that it might proceed from *oats*. This induced Dr. Wollaston to examine the structure of the oat-seed, and the result fully verified Mr. Clift's conjecture. If the oat-seed be denuded of its husk, minute needles, or beards, forming a small brush, are seen planted at one of its ends. Dr. Wollaston, on examining these needles, and comparing them with similar ones detached from the calculi, satisfied himself of their perfect identity. Hence these concretions were owing to the use of oats as an article of food: as oats are employed by the common people of Scotland as a common article of food, we see a reason why these concretions have been observed chiefly in Scotland. Mr. Children gives an account of some formed in the human intestines, in Lancashire, where also oat-meal is in constant use by the common people. (Phil. Trans. 1822, p. 24.) The other constituents of these calculi are albumen, common salt, phosphate of lime, and phosphate of soda.

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[*] Ann. de Chim. et de Phys. 31,290.

These are not the only calculi which have been found in the human intestines. Mr. E. Brande described some composed entirely of *carbonate of magnesia*, resulting from an excessive and continued use of magnesia for a long time. In one case a collection of several pounds of this substance was found lodged at the head of the colon, which in consequence was much distended. (Royal Institution Journal, i. 297.)

Dr. Marcet describes intestinal calculi voided by the rectum possessing the properties of indurated curd or cheese. (Marcet on Calculous Disorders, p. 127.)

He describes other small granular concretions, which were conjectured by Dr. Wollaston to be the small woody knots which are often found in certain pears; and upon close examination this conjecture was found correct. (Marcet on Calculous Disorders, p. 132.)

Some years ago the writer of this article received from an eminent physician in Birmingham a number of small flattened oval particles, which had been voided by a patient of his. They had all the appearance of seeds, but did not resemble any seed with which we were acquainted. At last, after carrying about the bodies for a considerable time and comparing them with the seeds of every species of fruit which he had an opportunity to inspect, we found that they were the seeds of figs. The patient had been eating green figs, the seeds of which had been voided entire.

Mr. Children gives an account of a very remarkable intestinal calculus which destroyed the life of John Chambers, a young carpenter at Clithero in Lancashire, who had been in the habit of eating large quantities of unripe plums, and of swallowing them together with the stones. Three concretions were formed in the arch of the colon, having a plum-stone for a nucleus, which in a short time destroyed his life. These concretions, together with some others collected by Mr. Barlow and Mr. Coultate, surgeons in Lancashire, which are deposited in the Museum of the Royal College of Surgeons, London, appear, from Mr. Children's description, to be intermediate between the *oaten* concretions in the collection of Dr. Monro and Dr. Hunter, and the triple phosphates, which occur so frequently in the intestines of the inferior animals. They were laminated, and composed of alternate layers of the felted fibres of the oat and the triple phosphates. The following table exhibits the constituents of one of these concretions as determined by Mr. Children:

Animal matter, chiefly gelatin	25·20
Resin	3·90
Ammonia-phosphate of magnesia	5.16
Phosphate of lime	45·34
Fibres of the oat	20·30
	99·90*

The calculi found in the intestines of the inferior animals were examined with much care by Fourcroy and Vauquelin many years ago. They describe the following varieties:

1. **Biphosphate of Lime Calculi.**—They are composed of concentric layers, and very brittle. They redden vegetable blues, and are partially soluble in water.

2. **Phosphate of Magnesia Calculi.**—These concretions are described as semi-transparent and of a yellowish colour. Their specific gravity is 2·160. They are laminated. They are doubtless very uncommon. We ourselves have never had an opportunity of seeing any of them.

3. **Ammonia-phosphate of Magnesia Calculi**—said to be very common. Their colour is grey or brown, and they are composed of crystals diverging like rays from a centre.

4. **Fungous Calculi.**—These concretions are composed of pieces of the boletus igniarius, disposed in layers, and cemented by animal matters. These pieces had of course been swallowed by the animals in whose intestines they were found.

5. **Hairy Calculi.**—These are found in the stomach and intestines of cows and sheep. They consist of balls of hair felted together, and generally coated externally with a very thin crust of animal matter. The hair had obviously been licked by the animals from their companions, and had been felted by the action of the stomach and intestines. There are several of these concretions in the collection of Dr. Hunter belonging to the University of Glasgow. The same collection contains enormous calculi composed almost entirely of phosphate of lime; but as there is no history attached to them, we have not ventured to describe them, because we do not know from what animal, or from what part of the animal, they were obtained.

6. In the same collection are five or six of the celebrated oriental *bezoars*, once so much sought after as medicines of approved efficacy. They are all smooth and polished, and have a greenish colour. They are small and round, and long, so as to have a considerable resemblance to a cylinder rounded off at the ends. Three of these bezoars, sent by the Schah of Persia to Bonaparte, were found by Berthollet to be composed of fragments of wood. Another kind of these bezoars (probably artificial), analysed by Fourcroy and Vauquelin, was found composed chiefly of resin.

IV. OSSIFICATIONS.—Concretions are apt to appear in various glands of the living body. These consist constantly of phosphate of lime and animal matter; or of a mixture of phosphate and carbonate of lime and animal matter. In some rare instances they consist almost exclusively of carbonate of lime and animal matter. The seats of these *ossifications*, as they may be called, are the pineal gland, the salivary glands, the pancreas, the lungs, the liver, and the spleen. The concretions coughed up from the lungs usually contain some carbonate of lime, and in some rare cases seem to be nearly destitute of phosphate of lime.

V. CALCULI OF THE PROSTATE GLAND.—[*Prostatal Calculi.*—Prout.] Calculi occasionally form in the prostate gland, sometimes in great numbers at a time and of small size, but occasionally in smaller numbers, and of a size nearly as large as that of a hazel-nut. Often they do not exceed the size of the head of an ordinary sized pin, and they are rarely larger, judging from those which we have seen, than a pea. These calculi were first examined by Dr. Wollaston, who found them composed of phosphate of lime, mixed with more or less animal matter. Dr. Prout informs us that he has met with calculi from the prostate gland containing a considerable proportion of carbonate of lime. The writer of this article has met with five or six which contained very little earthy matter, but which were composed chiefly of a substance having considerable analogy to cystic oxide.

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* Phil. Trans. 1822, p. 28.

These calculi, when small, are nearly spherical, and have a yellowish brown colour: those of a large size are smooth and polished, and have the appearance of porcelain; precisely similar, indeed, to the phosphate of lime calculi formerly described. Dr. Prout is of opinion that these porcelainous calculi always originate in abscesses of the prostate gland. But there are not a few of them in Dr. Hunter's collection of such a size that they could not possibly have been deposited in any cyst of the prostate gland. These calculi sometimes give little uneasiness, and are not suspected till after death.

[The composition of all calculi of the prostate, according to Dr. Prout, (*On the Nature and Treatment of Stomach and Renal Diseases*, Amer. edit., from the 4th revised Lond. edit. p. 448, Philad. 1843,) is nearly the same,—that is, they consist chiefly of phosphate of lime, a little carbonate of lime, and animal matter. In different instances, the relative proportions of the phosphoric acid to the lime and the carbonate of lime appear to vary considerably.]

Urinary calculi. — The constituents of urinary calculi, so far as we know at present, are the following substances:—

1. Uric acid.
2. Urate of ammonia.
3. Urate of soda.
4. Phosphate of lime.
5. Ammonia-phosphate of magnesia.
6. Carbonate of lime.
7. Silica?
8. Cystic oxide.
9. Xanthic oxide.
10. Colouring matter of urine.
11. Purpurate of ammonia.
12. Fibrin.
13. Mucus.
14. Urea.

These substances seldom appear insulated or constituting each a whole calculus. In general several of them appear together, either mixed or constituting alternate layers. To enable us to form correct notions respecting the way in which they make their appearance in the urinary organs, it will be requisite in the first place to make a few remarks upon urine.

Urine, as is well known, is a liquid secreted from the blood by two large glands called the kidneys, possessing a remarkable structure which has been minutely described by anatomists. The quantity of urine voided daily differs very much in different individuals, depending in some measure on the quantity of drink and upon the state of the skin. But perhaps two pounds avoirdupois or 14,000 grains approaches somewhat to the general average. It is transparent, has a light amber colour, and, when voided, has an aromatic odour, which has been compared to that of violets. As it cools, this aromatic odour leaves it, and another succeeds, well known under the name of *urinous*. In two or three days this smell is succeeded by another, which has a considerable resemblance to that of *sour milk*. It has a disagreeable bitter taste, and a specific gravity which varies very much; but which may be stated as vibrating between 1·010 and 1·020; though in certain diseases it rises as high as 1·050, or sinks as low as 1·003. [According to F. D'Arcet (*L'Expérience*, No. lv., Aug. 1838), it varies between 1·001 and 1·060. Dr. Thomson (*British Annals of Medicine*, p. 5, Jan. 1837) found its specific gravity in an individual from 50 to 60 years of age, and in perfect health, to bear the average 1·013; — the lowest specific gravity being 1·004, and the highest 1·026: (see the writer's *Human Physiology*, 5th edit. i, 294: Philad. 1844.)]

It reddens vegetable blues, owing probably to the presence of a little urate of ammonia, and to some biphosphates which it always holds in solution. If we add to healthy urine a few drops of any acid, and set it aside for some time, small red coloured crystals are deposited. These consist of uric acid tinged by some colouring matter. If we evaporate a quantity of healthy urine to one half its natural bulk, and then mix it with nitric acid, and set it aside in an open vessel, a number of beautiful crystals in plates make their appearance. They have a light yellowish brown colour and a silky lustre, and consist of *urea* combined with nitric acid.

The presence of sulphuric acid can be detected in urine by means of a solution of chloride of barium; muriatic acid may be detected by nitrate of silver; and phosphoric acid by nitrate of lead; the white precipitate thrown down by which, as far as it is a phosphate, being again dissolved by the addition of nitric acid. Lime may be detected by means of oxalate of ammonia. The quantity of magnesia in urine is so small that it is scarcely possible to detect its presence by re-agents. But if a quantity of healthy urine be left for two or three weeks in a cylindrical glass vessel, the mouth of which is covered with paper, and then be poured out, we shall find attached to the sides of the glass a number of small transparent crystals consisting of four-sided prisms with square bases. These crystals constitute a double salt composed of

One atom phosphate of ammonia	6·625
One atom phosphate of magnesia	7

The formation of these crystals proves evidently that magnesia exists in urine, though only in minute quantity. Urine also contains potash, soda, and ammonia; the last of which may be detected by the smell, if we add caustic potash to urine concentrated by evaporation over sulphuric acid in the vacuum of an air-pump. If we continue this evaporation nearly to dryness, crystals of sulphate of potash and sulphate of soda make their appearance in it, proving that both potash and soda enter into the constitution of urine. The following table exhibits the constituents of healthy urine according to Berzelius's analysis, which is the latest that we have.

Water	93·300
Urea	3·010
Uric acid	0·100
Mucus	0·032
Lactic acid, lactate of ammonia, &c.[*]	1·714
Sulphate of potash	0·371
Sulphate of soda	0.316
Phosphate of soda	0·294
Phosphate of ammonia	0·165
Chloride of sodium	0·445
Sal-ammoniac	0·150
Earthy phosphates, with a trace of fluorid of calcium	0·100
Silica	0·003
	100·000

Besides these substances, which form constant ingredients of healthy urine, this liquid in different diseases has been found to contain albumen, fibrin, and red globules of the blood; nitric acid, purpuric acid, oxalic acid, carbonic acid, benzoic acid; cystic oxide, sugar, bile, pus, and doubtless also xanthic oxide, though that has not yet been ascertained by observation.

Of these different constituents of urine there are only two that it will be requisite to describe particularly in this place. These are urea and uric acid.

Urea, when pure, is a transparent colourless substance, having a pearly lustre and crystallizing in four-sided prisms. Its taste is feeble; but it leaves a sensible coldness on the tongue like nitre. Its smell is slight, but peculiar, and quite different from that of urine. When exposed to damp air it deliquesces, but does not seem to be decomposed. The specific gravity of its crystals, as determined by Dr. Prout, is 1·350. At 60° water dissolves more than its own weight of it, and the solution may be exposed to the air without undergoing any change, provided it be pure; but if it be contaminated with the smallest quantity of foreign matter, it is speedily converted into carbonate of ammonia. Boiling water dissolves any quantity of it whatever. Alcohol of 0·816 dissolves at 60° about the fifth part of its weight of it, and at a boiling heat more than its own weight; but when the liquid cools, the excess of urea separates in crystals. When mixed with the caustic alkalis or alkaline earths, and heated (provided water be present), it is decomposed and converted chiefly into carbonate of ammonia. A number of curious facts, respecting the relation existing between urea and cyanogen have lately been discovered, which throw considerable light upon the occasional existence of prussic acid in urine,—a fact which seems pretty well established; but it would lead us too far from the subject of calculi to state them here.

[By the aid of the microscope, the presence of a very minute proportion of urea may be ascertained. If its aqueous or alcoholic solution be evaporated, and then a little nitric or oxalic acid be added, delicate silky crystals of nitrate or oxalate of urea are perceptible. The evaporation should be performed on a glass slide, and the subsequent crystallization be examined by the microscope. (Dr. Griffith, *Practical Manual*, &c., p. 17, Lond. 1843.)]

Uric acid, when pure, is a white, tasteless substance, existing either in powder or in minute crystals, which seem to be four-sided prisms. It has no smell. According to Dr. Henry, it is soluble at 60° in 1720 parts of water; but Dr. Prout could not dissolve it in 10,000 times its weight of water.[†] It dissolves readily in a solution of caustic potash or soda, from which it may again be precipitated in a white powder by the addition of almost any acid. It dissolves in nitric acid with effervescence, when assisted by heat. When the solution is gently concentrated, crystals of erythric acid form in it. When the liquid is evaporated to dryness, a beautiful pink sediment remains, which is a characteristic of this acid. On one occasion we have seen uric acid converted into urea by digestion in nitric acid. The experiment was made by a surgeon who wished to determine the nature of a calculus which he had extracted. The result not being satisfactory, he brought both the calculus and the substance into which he had converted it, to the writer of this article. The calculus was the common uric acid calculus, mixed apparently with muriate of ammonia. The substance into which it had been converted was urea. The surgeon could not give a satisfactory account of the process which he had followed, and we attempted in vain to repeat it successfully.

Uric acid combines with the different bases, and forms salts nearly insoluble. The urate of ammonia is the most soluble; it dissolves in about 480 times its weight of water, and the solution has the property of reddening vegetable blues. If we put a quantity of healthy urine under the exhausted receiver of an air-pump over sulphuric acid, and allow it to evaporate spontaneously, a sediment of urate of ammonia gradually attaches itself to the sides of the vessel in which the urine is. This seems to prove that in urine the uric acid is in the state of urate of ammonia.

[Uric or lithic acid is always crystalline. As occurring in urine, the crystals are always coloured. Their varieties of form are endless; and they are either separate, or combined in clusters. When separate, the outlines are either rhomboidal, square or rectangular; and all their varieties, according to Dr. Griffith, (*op. cit.*,) are explicable by assuming them to be derived from the right rhombic prism. When examined by polarized light, the crystals of lithic acid develope splendid colours.

Urate or lithate of ammonia is almost always amorphous. The radiating needles, seen upon its surface have been described as composed of superlithate of ammonia; but Dr. Griffith states, that he has not obtained enough to enable him to speak positively on this point.]

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[*] The writer of this article has in vain endeavoured to ascertain the presence of these bodies in urine.

[†] The probability is that both of these statements (incompatible as they may at first sight appear) are substantial correct. Dr. Henry probably digested uric acid in water of 60°, and evaporated a given weight of this water to dryness in a moderate heat, and weighed the uric acid remaining. Dr. Prout, on the other hand, digested one grain of uric acid in 10,000 grains of water without being able to dissolve it. The first experiment shows the *quantity* of uric acid which water can dissolve when the attraction of aggregation is destroyed; the second the *power* which water possesses to destroy this attraction of aggregation.

Let us now take a view of the different urinary calculi, that we may see what light our knowledge of the urine will throw upon their formation.

1. **Uric acid Calculi,** [*Lithic acid Calculi.*]—The uric acid calculus is by far the most common of all, and to judge from the number of calculi which the writer of this article has had an opportunity of inspecting, at least two-thirds of the concretions formed in the kidney or urinary bladder owe their origin to the deposition of uric acid, either in a pure state, or combined with ammonia. As healthy urine contains urate of ammonia to the amount of about 1-813th part, and as this salt requires about 480 times its weight of water to dissolve it, we see at once, that, if by any derangement in the digestive organs the quantity of urate of ammonia in urine should be tripled, a portion of it would of necessity be thrown down, as the urine would not be sufficient to hold the whole of it in solution: for the urate of ammonia would amount to 1-271st part of the urine; so that about three-eighths of it would precipitate. Calculi composed of urate of ammonia are always small, and seem nearly peculiar to children. They are undoubtedly to be ascribed to the existence of an excess of urate of ammonia in the urine, which is a very common consequence of indigestion, proceeding either from the use of an excessive quantity of food, or of food which does not agree with the constitution of the child.

Whenever a free acid makes its way into the urine, uric acid constantly precipitates, and may give origin to a calculus unless it be voided along with the urine. Now, as there is always a quantity of free muriatic acid in the stomach, and frequently also acetic acid, it is easy to see how these, when they become excessive, may make their way to the urine, and occasion a precipitation of uric acid.

It is probable that most of these calculi have their origin in the kidney, from which they are not displaced till they have gained some size; for if either urate of ammonia or uric acid were to be precipitated in the bladder, as they would be in the state of a powder or of minute crystal, they would probably be voided along with the urine. But, after a nucleus has lodged in the bladder, it is easy to see how it increases in size; because the uric acid, &c., as precipitated, is deposited on its surface, and adheres to it.

Calculi composed of uric acid are generally of a brownish red or fawn colour, but occasionally approaching to the colour of mahogany. The surface is often smooth, but not unfrequently finely tuberculated. This kind of calculus is usually composed of concentric laminæ. Its fracture generally presents an imperfect crystalline texture, but sometimes an earthy one; in which case its colour is lighter, and it usually contains a mixture of urate of ammonia.

Before the blow-pipe this calculus blackens, emits a smoke having a peculiar colour, and is gradually consumed, leaving a minute quantity of white ash, which is generally alkaline. It is completely soluble in caustic potash, and precipitated again by any acid in the form of a white granular powder. When a fragment of it is mixed with nitric acid, and heated on a watch-glass, it dissolves with effervescence; and if the solution be evaporated to dryness, the residue assumes a beautiful pink colour.

This is by far the most common species of calculus. The number of calculi composed of uric acid alone, or only slightly mixed with other bodies, in the collection of Dr. Hunter, deposited in the Hunterian Museum belonging to the University of Glasgow, amounts to ninety-eight. Of these, sixty-seven are tuberculated on the surface. The largest of them measures three inches in length, and weighs 2340 grains. Another weighs 1817 grains. Most of them are composed of concentric laminæ, chiefly distinguishable by difference of colour, and in the density or looseness of texture. Some of them contain a small compact nucleus of uric acid; others not.

The uric acid calculi, quite smooth on the surface, in the same collection, amount to twenty-three. No other difference between these and the tuberculated calculi can be pointed out, except the appearance of the surface. Several of them are crystallized, and they consist of laminæ like the others. In some of the internal laminæ, tubercles can be distinctly recognised.

There are eight uric acid calculi in the collection, of a much whiter colour and more chalky texture than the others. Probably they contain urate of soda. One of these contains a piece of bright iron as a nucleus.*

Calculi of urate of ammonia [or lithate of ammonia] are so rare that their existence has been denied altogether. There is not one of them in the collection of calculi in the Hunterian Museum belonging to the University of Glasgow; but the writer of this article has had an opportunity of inspecting and subjecting to a chemical analysis a considerable number of such calculi. The late Dr. Monteath, surgeon in Glasgow, had a high reputation as an operator for the stone. He had preserved all the calculi which he had extracted, and among them there were no fewer than seven consisting of urate of ammonia. Most of them had been extracted from infants between the ages of two years eleven months, and nine years, though one was from a man of forty. It was dark-coloured, and in layers, and about the size of a wren's egg.

They were all small, but sufficiently large to be subjected to analysis without any great diminution of their size. The diameter of the largest was one inch and five-eighths.

Urate of ammonia calculi have a clay colour; the surface is in most cases smooth, but sometimes tuberculated. The stone is composed of concentric layers, and the fracture is very fine earthy. Before the blow-pipe it usually decrepitates strongly. It is much more soluble in water than uric acid calculus,† and when heated with caustic potash gives out a strong smell of ammonia. Liquid carbonate of potash or soda readily dissolves the urate of ammonia calculus, although they are incapable of dissolving uric acid calculi. The reason of this is, that a double decomposition takes place; the carbonic acid and ammonia unite together, and make their escape, while the caustic alkali combines with the uric acid. Two of these calculi consisted of urate of ammonia alone; two had a nucleus of uric acid, while the external part was urate of ammonia; and three were mixtures of uric acid and urate of ammonia.

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* Most of these calculi have been varnished. This is the reason why the iron has remained bright.

† It is not unlikely that the calculus originally examined by Scheele was composed of urate of ammonia. This would account for its solubility, which he found much greater than that of uric acid calculi ever is.

Urate of ammonia calculi are certainly rare. They seem to be mostly confined to infants, or at least to persons under puberty. They occasion a degree of irritation in the patient scarcely credible. The opening or shutting of a door, or the least noise or motion, produces a paroxysm of the most distressing kind.

Uric acid exists very frequently as the nucleus of a calculus, the greatest part of which consists of other ingredients; showing clearly to what cause the origin of the disease must be ascribed.

2. Mulberry or Oxalate of Lime Calculi.—Next to the uric acid, we conceive that the oxalate of lime constitutes most frequently the nucleus of urinary calculi. This calculus is usually of a dark brown colour, approaching to that of dried blood. Its surface is very rough and tuberculated. It is usually hard and compact, and, when cut through, exhibits an imperfectly laminated texture. Mulberry calculi commonly approach the spherical form, and are never very large. The diameter of the largest in the Hunterian collection belonging to the University of Glasgow, is two inches. It weighs 1323 grains. Before the blow-pipe this calculus expands into a kind of white efflorescence, which, when moistened and brought in contact with turmeric paper, stains it red, owing to the lime being deprived of its acid, and rendered caustic by the heat. When pounded, it dissolves slowly in muriatic or nitric acid; and the oxalate of lime may be again thrown down by ammonia.

There is a variety of this calculus called *hemp-seed calculus*, from some resemblance which it bears in colour and lustre to hemp-seed. It is remarkably smooth and pale-coloured, and always of a small size. A number of these hemp-seed calculi usually exist in the bladder at once.

[Oxalate of lime, when present in the urine, occurs in crystals, whose form is a very flat octohedron. As they lie upon the field of the microscope, they appear to have a rectangular or sometimes a square outline. When dry, they seem to have a smaller square placed within the larger, whose sides are opposite the angles of the latter. Sometimes, they appear in the form of dumb-bells. By polarized light the dumb-bells give the most splendid colours, whilst the octohedrons produce very little, sometimes no alteration. (Dr. Bird and Dr. Griffith, in *op. cit.*)]

As oxalic acid is not a constituent of healthy urine, it is not easy to conceive to what alteration in the blood or in the functions of the kidney its formation is owing. Probably the appearance of this acid is the consequence of the mode of living. From a paper by Mr. R. Smith, of Bristol, entitled *A Statistical Inquiry into the Frequency of Stone in the Bladder in Great Britain and Ireland*, it appears, that in the collection of calculi belonging to the Bristol Infirmary, amounting to two hundred and eighteen specimens, about five-twelfths, or almost one-half are either composed entirely of oxalate of lime, or contain at least a nucleus of that substance. Of the one hundred and eighty-seven calculi belonging to different practitioners in Manchester, described by Dr. Henry, about one-fourth are either composed of oxalate of lime, or contain it as a nucleus. In Dr. Hunter's collection belonging to the University of Glasgow, the number of calculi composed altogether of oxalate of lime amounts to only two. But those which contain a nucleus of oxalate of lime amount to fifteen. Of these, ten contain a nucleus of oxalate of lime, while the outer lamina is uric acid. Five have a nucleus of oxalate of lime, while the outer crust is triple phosphate. In three of the five there are three laminæ; 1. a nucleus of oxalate of lime; 2. a thick lamina of phosphate of lime; 3. a thin crust of triple phosphate.

We can draw no conclusion from their numbers, because Dr. Hunter has left no documents by which the localities from which he procured his calculi can be authenticated. As he did not himself practise as a surgeon, it is obvious that his collection must have been made by presents from other persons; and being a great favourite with his pupils, who were settled in almost every district of Britain, it is probable that he drew his supplies indiscriminately from the whole island.

3. Phosphate of Lime Calculus, [*Bone-earth Calculus.*]—This calculus is generally of a pale brown colour, and its surface is smooth like porcelain, so as to appear highly polished. It is very regularly laminated. The laminæ are usually thick and very easily separated from each other. The shape is mostly oval, and the size is sometimes very considerable. We have seen one taken out of the bladder, after death, of such a size that it must have nearly filled it. It does not fuse before the blow-pipe. It dissolves readily in muriatic acid, without effervescence, and is precipitated undecomposed by caustic ammonia.

Judging from the statements of Mr. Brande, Dr. Marcet, Dr. Henry, and Mr. Smith, who have described the constitution of no fewer than 823 calculi, this calculus in a pure state is exceedingly rare, and generally of a small size. The number of calculi composed entirely of phosphate of lime, in Dr. Hunter's collection, is 43. The largest is 2·8 inches in length; but it is not certain that it was from a human bladder. It weighs 2142 grains. The finest of these calculi is composed of five laminæ, easily separable, and quite smooth and polished on the surface.

There are 11 calculi in the same collection, composed chiefly of phosphate of lime, but the outermost coat of which is the triple phosphate. Thus the whole phosphate of lime calculi in this collection amount to 54, which approaches to one-fourth of the whole. But we are not certain that some of these may not have been from some of the inferior animals. The number containing a nucleus of phosphate of lime and an external coating of the triple phosphates is small, not amounting to a tenth part of the collection. There is not a single calculus in which a nucleus of phosphate of lime is followed by a lamina of uric acid or oxalate of lime.

As phosphate of lime (or at least *biphosphate of lime*) exists in urine, though in exceedingly minute quantity, there is no difficulty in conceiving how it might be deposited. Whatever has the property of rendering the urine alkaline, will of necessity precipitate phosphate of lime from it. For example, if the nature of the urea were so much changed that it should be converted into carbonate of ammonia, which happens out of the body whenever it is heated in contact with potash or soda and water, it is obvious that phosphate of lime would be thrown down.

4. Ammonia-Phosphate of Magnesia Calculi.—[*Ammoniaco-magnesian phosphate calculi; triple phosphate of magnesia and ammonia calculi.*] These are always nearly white. The surface is commonly uneven, and covered with minute shining crystals. The texture is not at all, or very imperfectly laminated. This calculus is soft, and easily broken and reduced to powder. But it is said sometimes to be hard and compact, and when broken, exhibits a crystallized texture, and is somewhat transparent. There is a remarkable calculus of this kind in the Hunterian Museum, belonging to the University of Glasgow. It was taken from the bladder after death, which it completely filled. It was sent to the museum by Dr. King, of Irvine. It is an oval stone, constituting a pretty exact cast of the bladder. Near the centre it is a little smaller, indicating a stricture of the bladder in that place. The length of this stone is five inches and a half. Its circumference where thickest is fourteen inches and one-sixteenth; but at the stricture only ten inches. Its weight is one pound fourteen ounces and eight grains avoirdupois. It is white and crystallized on the surface, bearing some resemblance to agalmatolite. It is composed of a nucleus of uric acid, having a brown colour, and composed of many concentric laminæ. The external crust is ammonia-phosphate of magnesia, mixed with some animal matter. This calculus is the largest which the writer of this article has ever seen. Before the blow-pipe this calculus gives off the odour of ammonia, and at length melts with difficulty. It gives out ammonia when treated with caustic potash, and is very easily dissolved by very dilute acids.

It is a rare thing to meet with a calculus composed entirely of ammonia-phosphate of magnesia. In the Hunterian collection belonging to the College of Glasgow, which consists of 225 urinary calculi and about 75 intestinal calculi, biliary calculi, and calculi belonging to inferior animals, there is not a single specimen of this calculus in a state of purity. But mixed with phosphate of lime it is by no means uncommon, and then constitutes what Dr. Wollaston called *fusible calculus*. It is usually white and friable, somewhat like a mass of chalk. It is sometimes very large. It fuses very easily before the blowpipe, and dissolves with great ease in dilute muriatic acid. There are fourteen such calculi in the Hunterian collection. The largest is three-fifths of an inch in length, and weighs 1758 grains. One of these calculi contains a piece of lead about the size of a crow-quill, and more than an inch long, which had served as a nucleus. A second has a nucleus of tin. Besides these fourteen composed entirely of the mixture of the two phosphates, there are seventeen calculi in the same collection having a nucleus of phosphate of lime, but whose external coat is the fusible calculus. It is curious that this external coat, which is usually much more abundant than the nucleus, is not concentric with it. The internal nucleus with which the calculus has obviously originated is frequently within a quarter of an inch of the outside of the calculus on one side, and more than an inch from it at the other side. It is obvious from this, that the accumulation of the fusible part of the calculus must have been very rapid.

As biphosphate of magnesia exists in urine, and as it becomes insoluble whenever the second atom of acid is saturated with ammonia, we can easily see that there ought to be a deposit of ammonia-phosphate of magnesia whenever the urine becomes charged with ammonia. Ammoniacal urine usually indicates a broken constitution; and it is remarkable that in such urine the quantity of earthy phosphates always increases enormously. Hence it happens that the fusible calculus frequently forms the outermost coat of large calculi, and that whatever may have been the original state of the urine when the calculous deposit began to be formed, it ultimately terminates, unless the irritating cause be removed, in the urine becoming alkaline, and the consequent deposition of the fusible calculous matter. Perhaps this may be owing in some cases to improper medical treatment; for Dr. Prout mentions calculi which he had examined, the outer crust of which consisted of urate of soda. In such cases the patient seems to have been subjected to a course of alkaline medicines till the urine was impregnated with an excess of soda. This occasioned the deposition of urate of soda, and would ultimately have led to the deposition of the triple earthy phosphates, and probably to the increase of their quantity.

[The bi or sesqui-basic triple phosphate of magnesia and ammonia, is composed of minute elegant stellæ. It is seldom found as a natural deposit, but may often be detected in urine which has become alkaline by keeping. The neutral phosphate is found in the form of beautiful prisms. Sometimes the angles are replaced by facets. These crystals are recognized by their transparency, absence of colour and peculiar forms. When examined by polarized light, the neutral phosphate produces the most brilliant colours. The stellar bi-basic triple phosphate produces little or no effect with polarized light. (Griffith, *op. cit.*)]

5. Carbonate of Lime Calculi.—These calculi are not very rare in the inferior animals, though they are very uncommon in man. Mr. Smith describes some which he had met with that bore a close resemblance to the mulberry calculi, and yet consisted of carbonate of lime. (Med. Chirurg. Trans. xi. 14.) Dr. Prout mentions some small calculi which he had seen composed almost entirely of carbonate of lime. They were perfectly white and very friable. (Prout's Inquiry, p. 93; [and *On the Nature and Treatment of Stomach and Renal Diseases*, Amer. edit. from the 4th revised Lond. edit. p. 448: Philad. 1843.]) In Dr. Monteath's collection, mentioned before, there was a small calculus, which had been extracted from a man in the 26th year of his age. It was white, but not friable, nor did it stain the fingers; it was composed of nearly one part of carbonate of lime and two parts of phosphate of lime. There was a very small internal nucleus composed of bright crystals, having the aspect of ammonia-phosphate of magnesia. This is the only calculus that we have seen having a nucleus of ammonia-phosphate, and the outer crust of which consisted of other constituents. Yet as the whole calculus was calcareous, it can hardly be considered as an exception from the general rule.

The carbonate of lime calculus is easily detected by the property which it has of dissolving in muriatic acid with effervescence, and the neutral solution is abundantly precipitated by oxalate of ammonia.

6. **Cystic Oxide Calculi.**—This calculus has a yellowish white colour, and its surface, which is commonly smooth, exhibits a kind of crystallized appearance. It is not composed of distinct laminæ, but appears as one mass, confusedly crystallized throughout its substance. The fracture exhibits a peculiar glistening lustre, like that of a body having a high refractive density. When in small fragments, it is semi-transparent. This calculus is very rare, only four or five specimens having yet been recognized. When treated by the blow-pipe, it gives out a peculiar and characteristic odour. It is very easily dissolved both in acids and alkalies, and crystallizes with both.

[Cystic oxide generally crystallizes in delicate six-sided and sometimes in quadrilateral plates. At times, the crystals are crenate at the margin, with a dark nucleus, and often irregular laminæ are perceptible on the surface. The effect with polarized light is various; sometimes colour is developed, but often not.]

7. **Xanthic Oxide Calculi.** — Of this very rare calculus only a single example has been hitherto observed. It was given to Dr. Marcet by Dr. Babington, who had it from one of his patients; but nothing farther is known respecting its history. It had an oblong spherical shape, and weighed about eight grains. Its texture is compact, hard, and laminated; surface smooth, colour cinnamon brown, and much heightened by adding caustic alkali to the calculus in powder. Before the blow-pipe it splits in pieces, burns black, and is consumed, leaving a minute particle of white ash. When distilled it yields a fetid ammoniacal liquid, from which carbonate of ammonia crystallizes. It is mostly soluble in boiling water when in fine powder, and the solution reddens vegetable blues. On cooling the greatest part again subsides in white flocks. It dissolves both in acids and alkalies, though much more readily in the latter than the former. When its solution in nitric acid is evaporated to dryness, the residue has a bright lemon yellow colour. This residue is partly soluble in water, to which it communicates its colour. Thence the reason of the name xanthic oxide, by which Dr. Marcet distinguished it. It is insoluble in alcohol, ether, and oxalic acid, and very sparingly soluble in acetic acid. (Marcet's Essay on the Chemical History and Medical Treatment of Calculous Disorders, p. 95.)

8. **Alternating Calculus.** — This, as the name imports, may consist of different layers of any of the preceding species. Hence its appearance may be very varied. The nucleus is usually uric acid or oxalate of lime; and the outermost crust is not unfrequently composed of triple phosphate. We have in the preceding account stated the different alternations, and the order in which they occur in the calculi belonging to the Hunterian collection in the College of Glasgow.—There was an alternating calculus in the late Dr. Monteath's collection, which deserves to be noticed. It was oblong, being 1·75 inches long, and 1·875 inches broad where widest. It was composed of three distinct substances. The nucleus was oxalate of lime, not however pure, but mixed with a little phosphate of lime, and with distinct traces of uric acid. The second layer was composed of uric acid mixed with some phosphate of lime. The outermost coat consisted of phosphate of lime mixed with a little uric acid. This outermost coat was divided into three distinct layers, each of them composed of the same materials. This calculus was not only composed of alternating coats, but each coat was a mixture of two or more constituents. Indeed, this mixture of different ingredients in the same coat is a very frequent occurrence in calculi. The most common mixture is that of urate of ammonia with the phosphates. In such cases the urine was undoubtedly alkaline; and such a state, when it continues, is very apt to occasion a redundancy of earthy phosphates, which of course would be neutralized and precipitated by the alkali present. This alkali, it may be presumed, is most commonly ammonia.

9. **Fibrinous Calculus.**—This calculus was sent to Dr. Marcet by Sir Astley Cooper. It was about the size of a pea, and had a yellowish-brown colour, somewhat resembling that of bees'-wax. Its surface was uneven, but not rough to the touch: its texture rather fibrous than stratified, and the fibres seemed to radiate from the centre. When heated it took fire, swelled out, and burnt like an animal matter. It was insoluble in water and muriatic acid; but it formed a soapy solution when boiled with caustic alkali, from which it was precipitated by muriatic acid. Nitric acid dissolved it with difficulty. When boiled in very dilute acetic acid, it swelled to a great size, and was at last dissolved; and prussiate of potash, when added to the solution, threw down a yellow precipitate. These characters lead to the conclusion, that the calculus in question was composed of *fibrin*. (Marcet's Essay, &c., p. 101.) This kind of calculus is very rare, having been observed only in the case of a gentleman between fifty and fifty-five years of age, who passed in succession three such calculi.

Such is the nature of the different calculi to which the urinary organs of man are liable. The mulberry calculi are the most difficult of explanation, as they consist of a salt which does not exist in healthy urine at all; yet they are not uncommon, the mulberry calculi in Dr. Hunter's collection amounting to one-thirteenth of the whole. But by far the most common calculus is the uric acid one. They amount, in the collection of Dr. Hunter, to five-elevenths of the whole; and they are still more numerous in the collections which have been described by others. In Dr. Monteath's collection, which consisted of about thirty calculi, all of which he had extracted himself, no fewer than ten-thirteenths, or rather more than three-fourths of the whole, consisted of uric acid or urate of ammonia.

There is reason to believe that, when uric acid is deposited, the urine is *acid;* a state which is very apt to follow indigestion, or excess in eating and drinking.

The phosphate of lime calculi are generally considered as rare, and it is supposed that they are always small in size. If any conclusion can be drawn from the number in Dr. Hunter's collection of calculi, they amount to very nearly one-fourth of the whole. Some of them are very large; but as there is no catalogue nor history accompanying this collection, we cannot be sure that some of them are not from the inferior animals. Yet, as the calculi of the inferior animals are in this collection arranged in a separate drawer, it seems to follow that all the calculi in this part of the collection were considered by Dr. Hunter as human calculi.

The fusible calculi usually indicate a broken constitution. Hence this matter commonly constitutes the last coat of those calculi that have been long in the bladder, and which have been taken out after death. The calculi belonging to this class in Dr. Hunter's collection amount to nearly one-seventh of the whole. But if we take the phosphate of lime and the fusible calculi together, they constitute two-fifths of the collection. Probably they may be nearly as numerous as the uric acid calculi; but as patients afflicted with them frequently die, many of them are not extracted at all, and thus the number appears much less than it ought to do; whereas the uric acid being a deposit which is apt to be formed in a state of comparative health, the operation is much more frequently had recourse to, and of course their numbers appear much more formidable than those of the phosphates. [See, on the chemical history of urinary concretions, Dr. Golding Bird, in *Guy's Hospital Reports*, vii. 175.]

THOMAS THOMSON.

CALCULUS. (PATHOLOGY AND TREATMENT.)—The calculi which are found within the urinary organs are, of all those enumerated in the preceding article, the most important to the practitioner, and they have long attracted a large share of attention from medical men.

Urinary calculi are formed by the diseased action of the vessels which secrete the urine, or by a deposition from urine in a morbid state. They are also formed by the mucous membrane of the bladder, which sometimes secretes an altered fluid abounding in phosphate of lime; just as many of the concretions enumerated take place in other mucous cavities.

In considering the formation of urinary calculi, there are certain chemical facts which require to be stated before we can explain how precipitations from the urine occur. When any acid, even the carbonic, is added to healthy urine, a precipitation of lithic acid after a short time takes place; the acid thus added seizing upon the small proportion of ammonia in combination with the lithic acid, and by means of which it was held in solution. (Dr. Prout on Diseases of the Urinary Organs, 2d edit. p. 12, [and on the Nature and Treatment of Stomach and Renal Diseases, Amer. edit. p. 163: Philad. 1843.]) Thus we see how the presence of any uncombined acid in the urine will produce a lithic deposit, and give rise to calculous disease, or augment a calculus already in existence. The acid which seems most commonly to be the primary cause of lithic deposits, is the muriatic, and its source the stomach, where it abounds in most cases of indigestion.

On the other hand, by adding ammonia to healthy urine, a precipitate is produced, consisting partly of phosphate of lime, and partly of triple phosphate of ammonia and magnesia: part of the alkali uniting with the excess of phosphoric acid, which held the lime in solution, while another portion combines with the phosphate of magnesia, and forms a salt of very sparing solubility. Hence we perceive the connection which exists between ammoniacal urine and the deposition of the phosphates. The ammonia, thus performing so important a part in calculous disease, seems to be chiefly derived from the decomposition of urea, which is effected readily by the presence of the fixed alkalies and alkaline earths, and by various other substances. These remarks will serve to explain in what way precipitations from the urine do take place independent of a morbid excess of lithic acid, or of lime and magnesia; but it is by no means to be inferred that the excess of these constituents of urine is not respectively the immediate cause of a great majority of calculous cases.

When a calculous nucleus has been formed, if it do not escape by the natural outlet, it will receive from the urine by which it is washed successive additions of solid matter. It does not appear, however, that in all such cases there is a continual increase of the stone; for we often find it to consist of many distinct concentric laminæ, varying in thickness, and sometimes also in composition. It is, besides, obvious that the occurrence of a deposit will depend on the condition of the urine, which may be, and frequently is, so healthy that it lets fall no concreting matter. Calculi have been known to exist in the bladder for many years, yet without acquiring an extraordinary size, which they must have done had a continual increase been taking place. The mechanical process of the formation of calculi is sufficiently demonstrated by dividing them accurately through the centre; thus exhibiting their nucleus and the successive layers of which very many of them are composed. The nucleus is either itself a concrete formed by the kidney,—in two cases out of three lithic acid,—or some extraneous body which has found its way into the urinary cavities. The most common of such foreign bodies is a clot of blood; at other times the nucleus has been a fragment of a bougie, a small hair, a portion of lint introduced through the wound in lithotomy, a bit of straw, a musket-ball, a pin, a bodkin, and even a filbert. By such dissections of calculi we are enabled to trace out with accuracy the history of their formation, to mark the changes which the constitution of the urine underwent during the progress of the disease, and to satisfy ourselves that considerable intervals must have occasionally existed between the successive deposits.

Urinary calculi vary exceedingly in their size, form, and tenacity. Some calculi do not equal a millet-seed in size, while others have been found so large as to fill up the entire cavity of the bladder. Mr. Earle has described a very large stone which had been extracted, but with a fatal result, by the celebrated Cheselden. Its weight was 18½ ounces, its circumference in the large axis was 11¼ inches, in its short axis 10 inches. Dr. Charles Preston relates in the Philosophical Transactions, that he saw, at La Charité, in Paris, a stone which weighed 51 ounces. The patient died under the hands of the operator. Mr. Harmer, of Norwich, extracted from the bladder a stone which weighed 15 ounces, and had a diameter of 4¾ inches by 3½. The patient recovered, but a fistulous opening remained. (*Gooch*, Surg. Observat. p. 54.) In the case of Sir David Ogilvie, Mr. Cline performed the operation, but could not extract the stone. (Philos. Trans. 1810.) After death it was found to measure 16 inches in its longest diameter, and 14 in its shortest, and to weigh 44 ounces. The Breslau collection contains an account of a stone found in the bladder after death, which weighed 72 ounces. (Bresl. Sam. vol. ii. p. 434. 1724.) Kesselning relates that he saw, in Morand's Museum at Paris, a stone which weighed six pounds three ounces; and the model of another which was still larger. (*Haller*, Dissert. Chir. t. iv. p. 251.)

By far the largest calculus which we have ourselves seen is one presented to the Hunterian Museum at Glasgow, by Dr. King, of Irvine. It was taken after death from the body of a carter, who had for many years laboured under the disease. Its form is irregularly egg-shaped, with a slight constriction near the middle; its greatest circumference is $14\frac{1}{16}$ inches, its shortest 10 inches. It has unfortunately been broken, but it is now so carefully cemented together by means of plaister of Paris, that its appearance is in no way injured. The weight of the calculus as it now lies, together with some fragments kept for examination, has been ascertained by Dr. Thomson to be one pound fourteen ounces eight grains avoirdupois. It consists of two substances: one resembling light brown indurated earth, and forming the great mass of the stone; the other an incrustation of white closely crystallized matter, which envelopes all but one or two spots. The surface of this crystallized portion presents numerous short elevated lines and small indentations, corresponding apparently to the minute wrinkles of the mucous membrane with which it lay in contact.

Urinary calculi are usually spheroidal, and their surface is sometimes remarkably smooth, often covered with minute crystals, occasionally tuberculated, or beset with sharp projections. Calculi of the kidney, when of large size, sometimes present a complete cast of the dilated cavities of that gland, and have the appearance of corallines. When several stones are contained within a cyst or pouch, their surfaces become adapted to each other, and the whole often forms one globular cluster. Instances are recorded where calculi have occupied the neck of the bladder and prostatic portion of the urethra, moulding themselves to the form of the cavity, and allowing the urine to drain away by their sides, (*Ballingall*, Ed. Med. Chir. Trans. vol. ii.) and several histories are to be met with of grooved (*Blancard*, Anat. Prat. Cent. i. Ob. 94. *Walter*, Mus. Anat. vol. i. p. 31) and even perforated calculi. (*Schurig*, Litholog. p. 371. *Blancard*, Anat. Pract. Cent. ii. Obs. 34.) Many calculi are so hard that they cannot be penetrated without great difficulty, while others are so loosely agglutinated that the pressure of the forceps in extraction readily crushes them into a substance like mortar. In other cases the calculous matter has never coalesced into a solid, but remains in a soft state, like newly-mixed plaister of Paris.

In reference to the medical history of calculi, they may be conveniently divided according to the situation in which they are found; into renal, vesical, and urethral. A fourth description of calculus found in the genito-urinary organs is the prostatal; but there is reason for believing that it is not derived from the urine.

1. Renal Calculi.—It is an observation as old as Fernelius, and it may be traced even higher, that all urinary calculi not formed on foreign bodies introduced into the bladder, originate in the kidney; and if we except phosphatic concretions, some of which appear to be formed in the bladder, the doctrine appears to be substantially correct. We will not attempt to describe in what exact mode a calculus is first formed in the kidney, nor is it likely that we shall even attain to more than a probable conjecture on this subject. As crystals of lithic acid have been found in the tubuli uriniferi, and even in the cortical part of the kidney, (*Wilson*, Lect. on the Urinary Organs, p. 213, 8vo. 1821,) there is good reason to believe that in many instances the material of calculus concretes almost at the moment of its secretion. If such solid granules be retained within the channels of the kidney, it is obvious that they must become the centres of attraction for other particles of concreting matter to arrange themselves around; and as they increase in size, they will serve, by their irritation, to derange the actions of the organs in which they are detained, and thus occasion the secretion of a morbid fluid, abounding in the materials of calculous concretions. Many dissections have shown the great size to which renal calculi may attain, and the extraordinary tenuity to which the secreting organ which surrounds them may be reduced; and that too in some cases without destroying its secretory function. A remarkable instance of such a calculus occurred in the person of a natural daughter of Sir Richard Steele. No nephritic symptom took place until shortly before her death, when severe pain was felt in the region of the right kidney, fever followed, and speedily proved fatal. A calculus of oxalate of lime, weighing 7½ ounces, was found in the right kidney, which was so thinned by absorption as to be reduced to a mere membrane. In this instance the stone could be felt during life through the loins, inducing the belief that the kidney had become ossified. (Catal. Museum R. Coll. of Surg. Lond. Note by John Hunter.)

Mr. Cline used to mention in his lectures that he had been able to detect the presence of calculus in the kidney of a very thin person. But such are extreme cases; and many instances are recorded, where, although renal calculus had been long in existence, no disease of the kidney was suspected during the lifetime of the patient. The symptoms are in general obscure, and rarely enable us to ascertain satisfactorily the presence of stone in the kidney. Among these may be enumerated, a feeling of weight and dull aching in the loins; sharp pricking sensations in the region of the kidney; obstinate pain, in some instances, at the scrobiculus cordis; frequent fits of vomiting; bloody urine, especially after exercise which shakes the body; numbness, cramp, pain, or œdema of the corresponding thigh; and, finally, occasional attacks of inflammation of the kidney. Attacks of this nature sometimes destroy the patient by their violence, but much more frequently end in the discharge of pus from the kidney, which escapes by the natural passages; while the patient gradually wastes away, and after much suffering from inflammation, or perhaps ulceration of the bladder, at length dies exhausted. It is from this propagation of disease to the bladder that frequent painful micturition comes to be a symptom of calculus of the kidney. In some rare instances the inflammation has produced thickening of the surrounding parts, and led to the formation of abscesses, which have presented in the loins and formed fistulæ, giving issue to the urine, and occasionally to small calculi. Cases are recorded in several of the older authors, where stones of considerable size were extracted by the incision of such fistulæ. Hence surgeons have been emboldened to propose and sometimes to perform the operation named nephrotomy, for the removal of renal calculi; but no distinctly detailed and well-authenticated case has come to our knowledge, where, without the previous existence of abscess of the loins, a calculus has been successfully removed by this operation. (See Mr. Hobson's relation of his own case, Philos. Transact., abridged, vol. iii.) Nor is it likely that the pelvis of the kidney could be safely approached with the knife without the previous security of that matting of the parts which must occur before an abscess can make its way to the surface of the loins. When a stone has been formed in the kidney, its weight, and the current of the urine which is constantly passing off, naturally tend to carry it down through the ureter; but it may be detained by the deep situation in which it has concreted, or by some prominent points of crystal, which serve to fasten it to the soft surface on which it lies; or, after it is loose, its size may be such as to prevent it from entering the ureter. In some instances the calculus has lain in the orifice of that tube, and remained there as a plug, allowing the urine in part to escape, yet keeping, at the same time, the pelvis and infundibula generally distended, and in this manner dilating these cavities gradually to a great extent; causing absorption of the substance of the kidney, and reducing it at length to a mere capsule, having many cells communicating one with another. When the distended and attenuated kidney is seized with inflammation, pus is formed, the interior receives a lining of albumen, and the gland becomes like the cyst of a large chronic abscess. When the stone is very small, it occasionally passes along the ureter without producing any sensible effect; but in general the system feels the influence of the unwonted impressions which it induces. The patient is usually seized with nausea and vomiting; a feeling of alarm takes place, with cold chills and smart shivering; pain, often agonizing, shoots from the loins down to the fold of the thigh, and thence along the limb. The pain is usually felt on the inside of the thigh; but in the recent instance of a lady who passed an irregular pea-like calculus of oxalate of lime, the pain stretched from the loin, by the crest of the ilium, along the outside of the limb. In men, the passage of a calculus along the ureter is generally marked by the retraction of the corresponding testicle, and sometimes even by inflammation of that gland. It is remarkable that, amid all this commotion, the circulation is usually unaffected. The pulse is calm and regular, and the skin nearly of natural temperature; thus proving that the symptoms are occasioned by a powerful impression on the nerves, and are wholly independent of inflammatory disease. But here, as in other cases of strong nervous impressions, inflammation will arise in consequence of this prolonged operation. Should the calculus be arrested in its progress down the ureter, all the symptoms become aggravated, inflammation in general speedily sets in, and, if not subdued, cuts off the patient. The greatest danger in such cases arises from the stone filling up the canal of the ureter, and obstructing entirely the passage of the urine; thus forcibly distending the cavities of the kidney, and inducing suppression of the secretion, which has been known to occur in both kidneys where only one of the ureters was obstructed. (*Brodie*, L. Med. Gazette. April 16, 1831.) It might be supposed that the ureter would in some cases become so distended above the impacted stone as to burst; but if this ever occur, it is certainly an uncommon accident. Several circumstances render its occurrence unlikely; one of the first effects of the pressure of the confined urine is to act mechanically on the secreting organ, and diminish or altogether suspend its functions; absorption of the aqueous part of the fluid also takes place, which relieves the distension of the cavities: while fortunately the ureter is very dilatable, and its contents are not urged forward by the spasmodic action of powerful muscles, as when retention of urine arises from obstruction of the urethra. The ureter is well known to be capable of great dilatation, when the current of urine is obstructed; it has sometimes been found as large as the small intestine, and elongated so as to have a zigzag form. Cases have even been met with where the capacity of the ureter is said to have equalled that of the bladder. The consequences of suppression of urine and of its absorption are low delirium, coma, and death. (See Ischuria.) A fatal result may also follow the retention of calculi in the ureter in a more gradual manner, by the occurrence of inflammation, ulceration of the ureter, and escape of the urine into the adjoining cellular tissue. In some rare cases of stone in the ureter, abscess has occurred, followed by fistulæ opening in the groin or lumbar region, and giving issue to the urine. Frank relates a case where a calculus was thus discharged from the left ureter. In many instances, although a calculus be detained in the ureter, its form is so irregular, or the relaxation of the tube is such, that the urine escapes by its sides, depositing new matter on its surface, and augmenting it far beyond the size capable of being transmitted along the ureter. The deposition of calculous matter under such circumstances is greatest above and below, thus giving the stone an oblong or cylindrical form. Sometimes one calculus only is found in the ureter; sometimes there are many smaller ones; and instances are recorded where its channel was found entirely filled up with gravel. A calculus has not unfrequently passed along the ureter until it reached the point where that tube pierces the coats of the bladder obliquely, and has there been arrested. Its extremity projecting into the bladder has been felt by the sound, and lithotomy performed for its extraction, which, to the credit of surgery, has in more than one instance been successfully accomplished. (*Le Dran.*—*Dessault.*)

2. Vesical calculus.—If the calculus, happily, drop into the bladder, there is a cessation for a time of all urgent symptoms; and should its size permit, it is expelled through the urethra. In the female, where the urethra is short and easily dilated, the calculus is usually discharged; and hence the greater rarity of stone in the bladder among women. Even when the stone has rested in the female bladder, and grown to so great a size as to fill up and form a cast of the partially contracted organ, its pyramidal form has enabled it to pass by gradually dilating the urethra; and it has been expelled with throes resembling those of parturition. Calculi of extraordinary size are recorded, in the Philosophical Transactions and other publications, to have been discharged by females in this manner.

In males, the length and narrowness of the urethra, and the spasmodic action of the muscles which embrace it, render the expulsion of a calculus from the penis much more uncommon than its passage through the ureter. In very few cases is a calculus forced through the male urethra without considerable suffering, and sometimes an incision is required to relieve the patient. Retention of urine for a longer or shorter period usually occurs. In one instance, where the recent formation of a false passage prevented the introduction of a catheter, puncture of the bladder became necessary, and was successfully performed through the rectum; the small calculus being expelled when the congestion and irritation of the parts had subsided. Retention of urine in infants has not unfrequently arisen from calculus sticking in the urethra, or plugging up its internal orifice. The practitioner, therefore, ought to be aware of the possibility of such an occurrence, and have recourse to the necessary method of ascertaining and removing the obstruction. A curved probe will often suffice, or a slender gum catheter may be introduced, and the water drawn off. If relief be not speedily given, the bladder inflames, constitutional symptoms arise, and the little patient is soon carried off. Many instances are recorded in which symptoms of calculus existed from birth. A male child, mentioned by Mr. Wilson, (*Wilson*, Lectures on the Urinary Organs, p. 210,) was unable, from his birth, to retain his urine; and, dying before he had completed seven months, a stone as large as a garden-pea was found in the bladder. Brendelius relates that two infants, one two days old, the other eight, passed calculi before death, and calculi were also found in their bladders. (*Brendelius*, Program. de Calculis Vesic. et cæteris Natal.; *also*, Observ. Anat. Dec. iii. ob. 1.) Loeseke found a calculis in the kidney of a new-born child. (*Loeseke*, Obs. Anat. Chir. Med. p. 39.) Fischer relates that a boy, in his twelfth week, after suffering excruciating pains, passed a calculus by the urethra as large as a date-stone. (*Haller*, Disp. Chir. t. iv. p. 79.) Hence we are warranted in believing that urinary calculi are sometimes formed during the fœtal state.

Should the calculus be retained in the bladder, which in the male most commonly happens, it receives a gradual addition of substance, and becomes a source of greater and greater irritation. Although the existence of stone in the bladder cannot be fully ascertained without its being felt by an instrument introduced into that organ, yet there are many symptoms which, when they concur, afford strong presumptive evidence of the fact. When a calculus is loose in the bladder, it is liable to constant changes of position, which usually occasiôn sharp pain; and in evacuating the urine, the stone is apt to fall upon the internal orifice of the urethra, causing sudden stoppage and severe straining. After smart exercise or jolting of the body, the urine is generally mixed with blood, from the abrasion of the mucous membrane, which is loaded with red vessels, and resembles during life the richest vermilion-coloured velvet, as we have seen in a case of eversion through a vesico-vaginal fistula.

The appearance of blood in the urine would be much more frequent in cases of calculus, were it not for the protection afforded by an increased secretion of mucus, which acquires in this disease an unnatural degree of viscidity; thus enveloping the calculus, and shielding the tender surface of the bladder. A copious secretion of glairy mucus is a constant attendant on the advanced stages of calculus, and also on diseased prostate and other prolonged irritations of the bladder. It is to be observed that this mucus is seldom passed in a separate state, but generally diffused and suspended in the urine, from which it gradually subsides, and coalesces into a gelatinous viscid mass, which adheres to the bottom of the vessel, even when it is inverted. When this separation has taken place within the bladder, it is voided with difficulty, and often plugs up the urethra, and causes a temporary retention of urine. The colour of the mucus varies according to the degree of irritation and the length of time it has existed. From being clear it changes to grey, then to greenish yellow; and at length, when the mucous membrane has become extensively diseased, it is largely mixed with purulent matter. The character of the mucus is alkaline, even when the urine is decidedly acid; and it is justly considered as the source of many of those deposits and spongy concretions of phosphate of lime which are found in the bladder.

The agony of a fit of stone is generally known; consisting of excruciatingly painful efforts to expel the urine, during which the abdominal muscles, the diaphragm, the muscular coat of the bladder, and the levator ani are all in a state of strong spasmodic action, and alternate but brief relaxation. From time to time this straining forces out a few drops of scalding urine, while part of the contents of the rectum are perhaps expelled at the same time with eversion of the bowel; but from neither is the least alleviation of suffering obtained. A vivid and accurate picture of the miseries endured in a case of calculus is exhibited in a paper by Dr. Marcet, where the patient has described his own feelings, (Med. Chirurg. Trans. vol. x.;) and if we are to give implicit credit to the histories of the blacksmith of Amsterdam, (Tulpius. Obs. Med. l. iv. c. 31,) and the cooper of Königsberg, (Walther. Thes. Med. Chirurg. Obs. Cur. p. 195, ob. 60,) who cut into their own bladders and extracted the stones, we shall have the strongest of all evidence that the sufferings from calculus are sometimes beyond human endurance.

The chief cause of all this agony seems to be the contact of the calculus with the sensitive internal surface of the neck of the bladder; at once irritating the parts to spasmodic contraction, and blocking up the passage of the urine; for the patient often finds that by reversing his posture, or perhaps resting on his head and shoulders, he obtains relief. The pain in the bladder shoots to the anus, the loins, down the limbs, and is felt in an especial manner at the extremity of the urethra, which causes boys affected with calculus to seize and pull at the penis. Hence elongation of the prepuce comes to be a symptom of stone, and the swelled and softened state of the little patient's fingers shows how often they are bedewed with urine. The ramifications of pain in a fit of stone are various and extensive, and in some cases reach even to the heel or sole of the foot; a fact which we have noted also in ulceration of the bladder. A reference to the multiplied connections of the lumbar plexus and the distribution of the great sciatic, the ultimate ramifications of which are sent to the sole of the foot, will serve to explain the great extent to which the pain of calculus shoots.

When a calculus is of great size, it is less liable to alter its position and is therefore usually productive of less irritation; the excruciating pain is commonly exchanged for a distressing sense of weight at the neck of the bladder. Calculi occasion comparatively little uneasiness when they are supported by the moderate contraction of the bladder within its upper fundus behind the pubes; and when they get into fixed situations, as behind an enlarged prostate gland, or in cysts formed by the protrusion of the mucous membrane between the bundles of the overgrown muscular coat. This state of overgrowth of the muscular tunic of the bladder occurs in calculus, as in all diseases of that organ where frequent and long-continued but ineffectual efforts are made to expel the urine. Instances are occasionally met with when several, sometimes many stones are found separately lodged in such pouches in the same bladder; and preparations of this description are to be seen in most pathological collections. A stone, which had been distinctly felt by the sound, has sometimes been thrown into one of these cavities; thus an end has been put to the irritation, and it has eluded the examination of the sound, inducing the belief that there was no longer a calculus in the bladder. Both the formation of pouches in the bladder, and the enlargement of the prostate gland, are to be considered as consequences of the irritation of calculus; and they illustrate, in a striking manner, the operation of that conservative principle by which even the uncontrolled progress of diseases produces changes which tend to the relief of the patient. A still more remarkable proof of the same fact is afforded by those cases where calculi have ulcerated through the coats of the bladder, and have been discharged from the body, sometimes through the walls of the hypogastrium, at others into the rectum, and in other instances into the vagina. Canmond and Deschamps relate cases of the first, (Journal Générale de Méd. t. 27, p. 353, &c.; an. 1806, No. 124,) and Johnstone of the second, (*Johnstone*, Mem. Med. Soc. Lond. iii. p. 536.) In Mr. Johnstone's case, the patient, after years of suffering from the usual symptoms of stone, at length discovered pieces of gravel in his stools, which Mr. Johnstone was confirmed were urinary concretions. From that time all the painful feelings ceased, and the patient recovered perfectly, without any fistula remaining. A female, who, at the age of twelve, got rid of a pretty large calculus by ulceration into the vagina, is now, after ten years, in good health, but still suffering under vesico-vaginal fistula, (Edinb. Med. and Surg. Journ. vol. xxi.) It is probable that in such cases the stone had become imbedded in a pouch before ulceration commenced, otherwise it would have extended more widely over the internal surface, and proved fatal.

The occurrence of ulceration of the mucous membrane of the bladder is one of the last in the series of changes produced by calculus; and if the patient has withstood all the other exhausting circumstances of the disease, this seldom fails to put a period to his sufferings. In such prolonged cases the bladder after death exhibits various degrees of organic injury; the mucous membrane is extensively eroded, the ulceration sometimes reaching to the other coats of the bladder; or abscess has formed under its peritoneal covering. The internal surface is in many places lined with a layer of coagulated albumen, which is often encrusted with calculous matter. Such deposits appear never to fasten on the organized textures themselves, but on a layer of albumen which forms the medium of attachment between them. The urine is probably, in most cases, the source of this incrustation; but it may also be derived from the internal surface of the bladder, in the same way as earthy concretions are formed within the cavities of abscesses.

The effects of calculus in the bladder are not limited to that organ, but extend to the ureters and kidneys. The pressure of the urine, unable to escape by the urethra, dilates the ureters and cavities of the kidneys, and the latter often exhibit marks of inflammation, and are sometimes found suppurated, or small depôts of pus are discovered under the peritoneal covering.

The long-continued irritation of a calculus in the bladder, or indeed within any of the urinary organs, produces a change in the constitution of the urine, which loses its acid character, begins to abound in the phosphates, and at length becomes ammoniacal. In undergoing this change, the urine first deposits the lithate of ammonia, then the ammoniaco-magnesian phosphate, and the phosphate of lime. This morbid condition of the urine, termed the phosphatic diathesis, takes its rise under various other circumstances of impaired nervous energy of the kidneys and bladder, besides those connected with the wasting effects of protracted calculous disease. Thus injuries of the spinal cord; continued irritation of the urinary cavities from diseased prostate gland and strictures of the urethra; immoderate sexual indulgences; disordered health, and general irritability induced by excessive mental anxiety and fatigue; all have the effect of occasioning the phosphatic diathesis. Dr. Prout has satisfactorily shown that all varieties of calculus converge to this point, and ultimately end in the deposition of the phosphates. In proof of the correctness of this opinion it is sufficient to trace the progress of a long-continued calculous case, and to inspect the successive laminæ of which urinary calculi of long standing are generally composed. The formation of the phosphatic diathesis affords a clear indication that the constitution is breaking down under the sufferings of the disease, and requires that the question of a surgical operation should be considered without delay.

3. Urethral Calculi.—Calculi which have commenced their passage along the urethra may be detained in their way, and become imbedded in the side of the canal, where they will continue to receive new additions from the urine which washes over them. In this manner urethral calculi have occurred, and on many occasions they have attained a considerable magnitude. Their general situation is in the perineum, where they are found forming a hard prominent tumour. In some instances a single stone is contained in a cyst communicating with the urethra; in others there is a pouch filled with numerous small many-sided calculi, which have evidently lain closely packed together. On one occasion we witnessed the extraction of a stone from the perineum, which was as large as a pullet's egg, and consisted of two portions, one of them having its rounded extremity fitted into a cavity in the other. Mr. Sisley, in the Philosophical Transactions, gives an account of a calculus weighing five ounces two drams, which was expelled through a dilated urinary fistula at the upper part of the scrotum, (Phil. Trans. vol. xli. p. 351.) In an instance which came under our own observation, eighteen stones, varying from the size of a mustard-seed to that of a horse-bean, many of them polyhedrons, were removed from a cyst forming a hard tumour behind the scrotum, and communicating with the membranous portion of the urethra. The examination of one of these stones showed it to be composed chiefly of phosphate of lime deposited in concentric laminæ, from which and the yellow polished surface which they almost all possessed, we were led to believe them of prostatal origin. The following is probably to be referred to the same source. A case of very large perineal calculus, supposed to be of twenty years' growth, is related in the Philosophical Transactions, (Phil. Trans., abridged, vol. iii.:) a sharp angle of the stone was found to have penetrated the rectum. Its form was irregular, and it consisted of two parts, one jointed into the other.

The symptoms produced by calculi in the urethra, or in pouches communicating with it, are those of urinary irritation, and occasionally retention of urine; but they seldom attract much attention until the external tumour has become considerable.

4. Prostatic Calculi.—Small calculi are frequently found within the ducts and in abscesses of the prostate gland: sometimes they are contained in one cavity, at others disseminated in separate cells through the thickened substance of the gland. Their surface is occasionally rough, more frequently smooth and of a porcelain-like polish—their colour yellow or light brown—their size varying from a mustard-seed to that of a hazel-nut. Their chemical composition, unlike that of urinary calculi, is always the same. It appears that they are produced by the mucous membrane of the prostatal ducts, or by the suppurating surfaces of abscesses of that gland; and are not secreted by the kidney, or deposited from the urine, and therefore cannot in strict propriety be termed urinary calculi. They may, however, readily become the nuclei of such stones, either from the urine having access to them while imbedded in the gland, or by their getting loose and escaping into the bladder. Prostatal calculi have often been found after death, where no symptom had indicated their presence; more frequently they cause some degree of irritation at the neck of the bladder, particularly when the urine is voided; and if any portion of such calculus project beyond the orifice of the duct or abscess, it will be felt by a sound entering the bladder. The instrument in these cases frequently forces the small stone deeper into the cavity, and thus prevents it from being touched by the sound in several subsequent examinations, however dexterously conducted. It appears probable, from some of the cases referred to under the head of urethral calculi, that those of the prostate, when accumulated in great numbers, or of large size, occasionally form tumours in the perineum, or penetrate into the rectum.

Causes of urinary Calculus.—The importance of acquiring a knowledge of the causes from which urinary calculi arise, must be apparent to every one who considers that it affords the only means by which we are enabled to prevent the formation of this disease, the most painful in the catalogue of human maladies, and its recurrence after the sufferings and hazards of lithotomy. Calculus is more common in temperate than in warm or very cold climates: it is much more incident to early years than to any other period; and to old age more than to the prime of life. Among those beyond middle age, it occurs more frequently in persons of sedentary habits than in those who lead an active life; and in those who indulge in luxurious living much more than in the temperate and abstemious. Hence there has long been observed a marked connection between a calculous and a gouty tendency. But although the rich, the luxurious, and the indolent are at a certain age more prone to calculus than other classes, the poor and the destitute in early years enjoy no immunity from it; for the ill-fed and half-clothed children of the manufacturing and labouring population are frequently afflicted with stone. All authors who have written on this subject concur in stating, that females are greatly less subject to calculus than males, notwithstanding their more sedentary habits. The more temperate and regular modes of female life are less productive of the calculous tendency; and the absence of the prostate gland, and the short dilatable urethra of females, enable them much more readily to expel such calculi as have formed.

Much persevering research has been directed, by a succession of writers, to ascertain the comparative prevalence of calculus in different parts of the British islands, and among different classes of society. Ireland is still admitted to furnish very few instances of calculous disease; and there certainly are strong grounds for this opinion, although we have no doubt that the state of society in that island opposes many obstacles to the acquisition of a full knowledge of the facts on this subject. Scotland, which had been set down as affording a very small number of calculous cases, is now ascertained to have been quite underestimated. (*Mr. Hutchinson* in Med. Chir. Trans. vol. xvi.) The large manufacturing town of Paisley appears, from the very accurate returns furnished by Dr. M'Kinlay, (Ibid.) to be almost as productive of calculous cases as Norwich itself, having yielded, in the ten years from 1820 to 1830, eighteen cases of lithotomy in a population of probably 42,000. Both Mr. Hutchinson and Dr. Yelloly (*Dr. Yelloly* in Phil. Trans. 1830) seem to us to have estimated the population of Paisley too low; but making allowance for this, and some abatement also for admitting into the enumeration private as well as hospital operations, it must be granted that calculus is of comparatively frequent occurrence in that town. In further support of this opinion, it appears, from information kindly furnished to us by Dr. M'Kinlay, that the number of cases of lithotomy between 1810 and 1820 was probably greater than in the subsequent decade; and that, although no operation has occurred since his report, several cases of calculus in every respect favourable for lithotomy, are now (July 1831) known to exist in Paisley.

The comparative prevalence of urinary calculus in different parts of England has been elucidated by the inquiries of many able writers, from Dr. Dobson downwards. The number of hospital operations has been assumed by all of them as the basis of calculation; therefore the result must be considered as only a distant approximation to the truth; for the number of cases of lithotomy will not always preserve the same proportion to the real number of calculous cases, but will vary according to the dexterity, enterprise, and reputation of the surgeons of the place. Thus in Norwich, where distinguished operators have existed as far back as the beginning of the eighteenth century—witness the epitaph on the tomb of the ecclesiastic Havers—not a case of calculus can occur in the city or neighbourhood without being speedily detected, and probably operated on; while in many other districts, cases of stone are allowed to proceed for years unrelieved, and perhaps wholly unsuspected. The celebrity of an hospital surgeon, or his own exertions to obtain reputation, will often bring to him cases from very distant quarters, some of which may be assumed in calculation as belonging to the district where he resides. Frank (*Frank*, De Curand. homin. morb. De Calculo) tells us that, previous to the arrival of the celebrated Venetian lithotomist Pagola at Vienna, calculus was deemed rather uncommon in that metropolis, and only one or two operations were performed annually; but after the surgeons had acquired experience and dexterity from his example, the operation became frequent, and the cures numerous. He adds, that calculus was believed to be very rare in Lithuania, until the establishment of the surgical clinic at Wilna; but that now the surgeons who are skilled in the art of sounding find the disease but too common.

Norwich appears to be more productive of calculous cases than any other part of Great Britain, yielding one hospital case of lithotomy for every 21,000 inhabitants. On the other hand, the city and county of Hereford appear to be wholly free from calculous disease: from 1775 till the date of Mr. Smith's statistical inquiry (1818), no patient suffering under calculus had applied at the Infirmary; and Mr. Smith could not learn that lithotomy had ever been performed within the bounds of the county, (Medico-Chir. Trans. vol. ii. p. 20,) which, it is worthy of remark, is noted for its cider, a beverage hitherto supposed to be favourable to the production of calculus. Thus we have the two extremes of the great prevalence, and the apparent non-existence of calculous disease, in different districts of England. It has been supposed that the diet of the inhabitants of Norfolk is a main cause of their liability to calculus—a favourite article of food being hard boiled, ill fermented, greasy dumplings. These, no doubt, are likely to cause indigestion, and thus give rise to lithic acid deposits. To this it has been objected, that many cases of calculus occur in that district at so early an age that diet can have no influence in their production: but the diet of the nurse is known uniformly to affect the infant at her breast.

Mr. A. C. Hutchinson has shown in several able papers, that calculus is of particularly rare occurrence among seafaring people; and the hospital returns of the British army prove also that calculus is very seldom met with among our soldiers. [Sir William Burnet, having caused the returns of the British naval hospitals, at home and abroad, from April 1830 to Nov. 26, 1836, to be carefully examined, with reference to this point of medical statistics, it was found that the only instance of the kind was one of renal calculus in the hospital at Malta. The average number of seamen and marines voted annually by the British Parliament, during the period mentioned, including 2000 boys, was 30,000.] The information which has been obtained by Dr. Yelloly respecting the armies of France and Russia, shows likewise that calculus is a rare disease among the military of those countries. In explanation of these facts, it ought to be remembered that none are admitted into either navy or army but the robust and active; and that their services are chiefly limited to that middle period of life when calculus is very rarely observed to originate among the labouring classes from whom soldiers and sailors are drawn. But, after taking this fairly into account, we are not disposed altogether to deny the greater immunity from calculus enjoyed by individuals of both land and sea forces; and we think that this serves to confirm, what other observations clearly show, that a full supply of wholesome food, good clothing, active habits, and regular exercise, all tend to prevent the formation of calculus. The state of the digestion and of the cutaneous perspiration must be admitted to exert a powerful influence on the secretion of urine; for when the stomach habitually abounds with acid, the urine rarely fails to exhibit in excess a similar condition; and the perspiration influences, in a remarkable manner, the quantity of lithic acid contained in the urine, as the experiments of Dr. Wilson Philip have satisfactorily shown. (*Wilson* on Urinary Gravel: 1792.) Probably free perspiration is a principal cause of the infrequency of calculus in warm climates. The connection between calculous disease and a dry and harsh state of the skin, or even scaly eruptions, has long been remarked. In the case of Horace Walpole, it was observed that a cutaneous eruption, to which he had been many years subject, yielded to the alkaline remedies which relieved his calculous symptoms.

The tendency to calculus appears in many instances to be hereditary, like the kindred disease of gout. Dr. Prout and Dr. Yelloly both relate remarkable facts in proof of this opinion; and we are inclined to ascribe to the hereditary nature of calculus a part, at least, of that extraordinary tendency to the disease which has long existed in certain districts. Hitherto we have been unable to discover those local peculiarities of soil and situation which favour the formation of calculus; but if we admit its hereditary nature, we have obtained a key to some of those continued anomalies, which otherwise appear incapable of explanation. It is clear that, in a district where calculus is well understood, and lithotomy often successfully performed, a greater number of calculous individuals will be preserved to propagate their race, than in districts where the operation is most commonly fatal. And it is not beyond the range of probability that individuals who have come from distant quarters to some hospital of great repute, for the purpose of submitting to lithotomy, may settle in the city or its neighbourhood after the completion of their cure.

It has long been a popular opinion that hard waters are favourable to the production of calculus, and one of our latest and best writers on the subject expresses the same belief. The effects of such waters are diuretic, and sometimes slightly purgative, and they are apt to disorder delicate stomachs; but it is very doubtful whether the earthy salts which they contain contribute in any more direct manner to the formation of calculus.

[In the great valley of Chester county, in Pennsylvania, where limestone abounds, a case of stone is of rare occurrence. According to Dr. Thomas Harris, of Philadelphia, a respectable physician, who had been in extensive practice there for twenty years, had never seen a case of it. (The writer's *Practice of Medicine*, 2d edit., ii. 42: Philad. 1844.]

Injuries of the back have been remarked to produce a morbid condition of the urine, usually a change to an alkaline state; and cases of renal calculus have been distinctly traced to accidents of this nature; several very interesting examples of which have been related by Mr. Earle (London Med. Chir. Trans. vol. xi.) and Mr. Wilson. (Lectures on the Urinary Organs.) Such injuries influence the function of the kidney in different ways. A general concussion of the spinal cord, or a blow on the spine in the region of the kidney, will enfeeble its powers by diminishing the nervous energy distributed to it, and thus induce a morbid condition of the urine: such injuries will also tend to weaken the expulsive powers of the bladder, and by preventing it from ever being completely emptied, lead to the decomposition of the urine, and hence to the deposition of the phosphates. A blow on the kidney itself is likely to prove a cause of calculous disease, by the immediate effects of the concussion deranging the action of the organ; and by small extravasations of blood, which cause irritation as foreign bodies, and furnish nuclei for future concretions. Although clots of blood have often been found in the centre of calculi, it is obvious that blood has very frequently been effused within the kidney, yet no calculus has followed; the blood being washed away before it had time to cause that irritation of the urinary organs which disorders the urine and occasions deposits. For it is in this manner that extraneous bodies introduced into the bladder become incrusted with calculous matter,—causing in the first instance by their irritation a derangement in the secretion of the kidney, and then furnishing a solid inorganic substance to which the deposit may attach itself. In such cases the deposit is almost uniformly composed of the phosphates, but instances are met with where it is formed of lithic acid; as an example of which, we may mention a calculus in the museum of William Hunter, where this substance has formed a concretion, as large as a plum, around a fragment of iron.

Strictures of the urethra and enlargements of the prostate gland prove causes of calculus by the irritation which they produce on the urinary cavities, and by their subsequent effects on the general health, as well as by the obstruction which they present to the complete evacuation of the bladder.

Treatment of Calculus.—In the treatment of calculous disease, several different and highly important objects demand the attention of the physician—to correct the calculous diathesis and prevent the formation of stone—to facilitate the expulsion of calculi when formed—to relieve the sufferings of the patient, and delay the progress of the disease—and to point out the period when a surgical operation offers the best means of relief.

When calculus has been observed in several members of the same family, or in successive generations, it is to be presumed that a strong tendency to the disease exists in their constitution; and precautions are therefore to be adopted against its development. For this purpose, active habits ought to be encouraged, and the digestion preserved in as vigorous a state as possible; the diet being nutritious, but not heavy or acescent. A healthy state of the skin should be promoted by the use of the flesh-brush, by warm clothing, and occasional warm baths. Even a residence in a warmer climate during the early years of life, may, under certain circumstances, be advisable. On the first appearance of any thing unnatural in the urine, it ought to be carefully examined, for the purpose of adopting that plan of treatment which its chemical constitution requires.

The morbid states of the urine arrange themselves under the two great heads of the predominance of acid, and the predominance of alkali or alkaline earths. The acid diathesis is chiefly prevalent in infancy, and at the commencement of the decline of life; and in the early stage of most calculous diseases. It may be truly said to be by far the slightest deviation of the two from the healthy condition of the urine; for the function of the kidney has been satisfactorily shown to be an acidifying process; and the acid state of all healthy urine is proved by the change which it produces on litmus paper. The morbidly acid condition of the urine exists under various forms; from that in which lithic acid is deposited as a flocculent precipitate, or red gravel, to that where a calculus of lithic acid is receiving from day to day new additions of size. The urine in this diathesis, when first voided, is usually clear, not very plentiful, and is of a bright coppery colour. It occurs under circumstances apparently the most opposite — in the ill-lodged, half-starved, half-clothed child of the artisan or labourer, in connection with loose chalky stools, feeble digestion, and a pallid aspect, — as well as in the pampered plethoric adult, who enjoys the pleasures of a luxurious table and all the comforts of a modern house. The digestion of the latter individual is strong, but his stomach is overtaxed, and unable to accomplish the duty which is daily imposed on it: his countenance is florid, his frame robust, and his habit probably gouty. In both of these cases there is frequent acidity of the primæ viæ, but much greater in those of the luxurious liver than in the child: the difference, however, is more than compensated in the latter, by the harsh unhealthy state of the skin, which executes its function imperfectly, and leaves an additional task to be performed by the kidneys. Guided by these views, our first object in undertaking the cure of the child should be, to have him warmly clothed, comfortably lodged, and supplied with a nourishing diet, containing a moderate proportion of animal food. Excess in this article seems to dispose to the secretion of lithic acid. The medical treatment is to be commenced by a mild laxative of castor oil, or rhubarb and magnesia; and in many instances great benefit will be derived from small repeated doses of hydrarg. cum creta, or minute doses of calomel. After this, alkalies and tonics ought to be given for the purpose of correcting the acidity of the primæ viæ and of the urine, and of improving the powers of digestion. Rhubarb, gentian, calumba, and cinchona, may be enumerated as the best tonics; and of the fixed alkalies, potass is to be preferred to soda; for the lithate of potass is a very soluble salt, while the lithate of soda is so much the reverse, that it forms the *chalk-stones* of gout, and has been found by Dr. Prout to constitute occasionally a considerable portion of a urinary calculus. Although the fixed alkalies are usually employed, cases of the acid diathesis do occur, both in children and adults, where the stomach is enfeebled, and where ammonia will prove more beneficial. The volatile alkali has also the advantage of determining to the skin, which it is of great consequence to bring into a healthy state. This is the description of calculous cases which are so often met with in manufacturing districts, and which seem to have led Dr. Yelloly to suppose that there was a connection between the scrofulous and the calculous diathesis.

[It is affirmed by Dr. A. Ure, (*Provincial Medical and Surgical Journal*, July 17, 1841, p. 317,) that hippuric acid is found in the urine after benzoic acid has been taken, and that the quantity of uric or lithic acid is thereby diminished. He hence inferred, that the uric acid is converted into the hippuric; and as the hippurates are more soluble than the urates, it was suggested by him, that benzoic acid might be advantageously exhibited in lithuria or in cases of predominance of uric acid. The observations of chemists have not, however, established this. On the contrary, they have shown, that although the benzoic acid appears to be converted into the hippuric, there is no diminution in the quantity of the uric acid. (Liebig, *Animal Chemistry*, Gregory & Webster's edit., p. 316, Cambridge, U. S., 1842; and Professor Booth and Mr. Boyé, in *Proceedings of the American Philosophical Society at the Centennial Celebration in Philad.*, May, 1843.)]

In the instances in which a calculous tendency is combined with fulness of habit, a mode of treatment in many respects the reverse of that now described becomes requisite. A spare regimen and more active habits ought to be recommended; blood should be taken by cupping from the loins, or from the arm by venesection. Calomel should be given freely over-night, and followed next morning by rhubarb with magnesia, or Rochelle salts. The cure is to be completed and confirmed by the employment of alkalies and bitters, and by a rigid adherence to a system of moderate living and regular exercise.

Under the head of acid diathesis may be arranged, not only deposits of lithic acid, but those also of oxalate of lime and cystic oxide. It has been ascertained from the examination of calculi, that the lithic acid diathesis and that of the oxalate of lime alternate with each other, thus showing their near alliance and mutual convertibility. The cystic oxide diathesis, on the other hand, appears to be exclusive in its nature, all concretions of this kind being of remarkable purity: it is, however, sometimes followed by a deposition of lithic acid; and this, like the other species of urinary calculi, terminates in producing the alkaline or phosphatic diathesis.

The general principles of treatment in this class of calculous diseases, is, certainly, to counteract the acid tendency by the use of alkaline remedies;

but to this there are many exceptions. In the lithic diathesis it has sometimes been found very serviceable to produce a copious discharge of that acid, by the exhibition of turpentine combined with laudanum. Dr. Prout has employed, with advantage, the muriatic acid in cases of oxalate of lime diathesis; by which means he succeeded in converting it into that of the lithic acid, and thereby procured great relief to his patient. This eminent physician, who has so ably illustrated the various forms of urinary disease, and to whose writings the author of this article is so much indebted, proposes a similar practice in the cystic oxide diathesis, recommending the muriatic acid to be given wherever the state of irritation will permit, for the purpose of keeping the cystic oxide in solution, and establishing in its place the lithic acid diathesis.

[Liebig (*op. cit.*) and Wöhler ascribe oxalic acid to the oxidation of uric acid; and the former affirms, that it is a common occurrence in France, when patients, suffering from calculous complaints, go to the country, where they take more exercise, the compounds of uric acid, which were deposited in the bladder during their residence in town, are succeeded by oxalates, in consequence of the increased supply of oxygen. If these views be correct, it would seem, that country air might be injurious; but the matter cannot be regarded as established. (The writer's *Practice of Medicine*, 2d edit., ii. 49: Philad. 1844.)]

Should a calculous tendency appear to be connected with injury of the kidney, or a diseased state of that organ, the employment of counter-irritation, and especially of setons in its neighbourhood, is distinctly indicated; and their beneficial effects have been placed beyond doubt by the observations of Mr. Earle. (Lond. Med. Chir. Trans. vol. xi.)

When a gouty disposition coexists with a calculous tendency, the colchicum, in combination with the means already described, ought to be had recourse to; but if the bladder already contain a calculus, we cannot with safety push this medicine to its full effect on the bowels, which in cases of simple gout and rheumatism is often found beneficial.

In the alkaline or phosphatic diathesis, the naturally acid condition of the urine is exchanged for an alkaline state; and the deposits now consist of the phosphates. This is a much more formidable deviation from health than that which we last considered, for it arises as a consequence of other disease, and is usually connected with a shattered state of the constitution. Our first object ought to be, to ascertain the cause from which the phosphatic diathesis has arisen, and to remove or palliate it as far as we are able. The spinal cord should be relieved by counter-irritation, varying, according to circumstances, from a galbanum plaister to a seton or a caustic issue — the effects of diseased prostate alleviated by such means as we possess; and if the symptoms have arisen from calculus in the bladder, its early removal by operation presents the only mode of effecting a cure. A free air, gentle exercise, and a mild nutritious diet, ought to be prescribed; and the tone of the digestive organs restored by means of the mineral acids, bitters, and astringents. The acids have been supposed to exert a direct influence on the urine, and there is no doubt that they do pass the kidneys unchanged; but their chief beneficial effects in the phosphatic diathesis are accomplished by influencing the organs of digestion. The sulphuric, nitric, and muriatic acids, have all been employed; and the last has been found most generally useful. Among the bitters and astringents the uva ursi and pareira brava have deservedly obtained a preference. Medicines which cause a copious secretion of lithic acid, such as the turpentines, the seeds of the *daucus sylvestris*, and *alchemilla arvensis*, might be supposed to prove beneficial when an opposite diathesis was known to prevail; and cases do occur in which they are found serviceable: but in the greatest proportion of such diseases, the irritation of the urinary organs is so great as to render their employment improper. Indeed, it is obviously of little consequence to induce for a time a free secretion of lithic acid, without also improving that shattered state of health with which the morbid condition of the urine is generally connected. It is worthy of remark that such remedies are powerfully diuretic; now in the phosphatic diathesis the urine is almost always superabundant, at times excessive, which forms another objection to their employment. This tendency to an unnatural increase of the urine, and the irritation, anxiety, and pain attending the alkaline diathesis, point out opium as a valuable remedy; and here, as in other states of prolonged suffering, it has proved truly a blessing. Among the various forms in which this drug may be administered, perhaps the best are the black drop, Battley's liquor, and Dover's powder. Other anodynes, as hyoscyamus, conium, and belladonna, may be employed under less urgent symptoms; and they often produce very excellent effects.

Although mercury is certainly entitled to a place among the causes of the phosphatic diathesis, and is therefore, on general principles, to be avoided, yet under certain circumstances mercurials are productive of great benefit. Dr. Prout has well remarked that in children whose urine deposits the phosphates, repeated doses of calomel and rhubarb are exceedingly useful; without doubt, by correcting the disordered functions of the digestive organs: and in cases of excessive irritation of the urinary cavities we have found the full operation of calomel and opium signally beneficial. The existence of the phosphatic diathesis is so generally combined with a morbid state of the alimentary canal—the stools being too pale, or too dark, or yeasty—that it is quite obvious laxatives and alteratives must be given; but drastic purgatives, and even free purging, are to be avoided on account of the tenesmus which they are apt to occasion. The great importance of attending to the feelings of the patient under this form of calculous diathesis, and of removing when it is possible every source of care and anxiety, is sufficiently obvious. Relief from the irritations of business and the fatigues of study is equally required; and a change of scene and air, when the patient can be moved, is productive of great benefit.

Such are the modes of treatment which appear to be best adapted to correct the two principal forms of calculous diathesis, whether the morbid condition have recently arisen, or be combined with the existence of stone.

When symptoms indicate that a calculus is passing from the kidney to the bladder, the physician is usually called under circumstances of great anxiety and alarm. In such cases, although the pain be urgent, it is not always necessary to abstract blood: it is a remedy, however, which ought to be kept in view, and employed on the slightest appearance of a tendency to inflammation. In the robust and plethoric, venesection is a wise measure of precaution, and will have a useful effect as a relaxant: even in persons of a less vigorous frame, when inflammation threatens, the immediate relief obtained by bloodletting renders it preferable to cupping and the application of leeches. During the passing of a calculus, all the various methods of allaying pain are sometimes required;—warm fomentations, bags of hot salt, hot poultices, the warm bath, and anodynes in every various form and mode of exhibition. Some difference of opinion may exist as to the propriety of giving diluents freely in such cases, so as to produce an increased secretion of mild urine; but it does not appear likely that a copious flow of urine will in any case prove hurtful; for if the calculus be not too large to pass, the increased current of fluid will certainly render the process more easy; nay, there is reason to believe, that by exposing a calculus to the constant washing of any aqueous urine, some of those spiculæ which detain it in its passage may be dissolved or worn away. Should the calculus be so smooth and so impacted in the ureter that no urine can pass, the probably fatal result is not likely to be much hastened by the use of diluents.

When the calculus appears to be delayed in the uretur, a brisk purgative of rhubarb and sulphate of potass, followed by an enema, will be found to facilitate its progress. After the renal calculus has dropped into the bladder, free dilution with bland liquids or pure water ought to be persevered in to a still greater extent; and brisk purgatives of castor oil, or rhubarb and sulphate of potass repeated at intervals. Should the small stone still be retained, its removal should be attempted by dilatation of the urethra. By such means we shall often succeed in ridding the patient of what would entail torture on his future days, or bring his life into hazard by the operation of lithotomy.

When a calculus is lodged in the bladder, and there is no longer any prospect of its expulsion by the urethra, the exertions of the physician are chiefly limited to the two objects of lessening the sufferings of his patient and preventing an increase of the stone. The general treatment is to be conducted on the principles already laid down for the management of the prevailing diathesis, whatever that may be; since by such means we shall be most likely to accomplish the two objects stated above. The irritation of calculus in the bladder is in most cases remarkably relieved by the administration of alkalies in the acid diathesis, and of acids in the phosphatic; but the soothing effects of the alkalies in the former of these cases, is by far the more striking and uniform. Nay, the power of the alkalies to allay the irritability of the urinary apparatus seems not always limited to those cases where the acid diathesis prevails; and it is worthy of remark that their efficacy is not diminished by combining them with the vegetable acids.

Gentle exercise on foot, frictions, shampooing, warm clothing, great attention to the diet and to the state of the bowels, are all necessary in the management of calculus of the bladder. Straining at stool, whether from a confined state of the bowels or the smart operation of medicine, is to be carefully avoided; therefore only the mildest laxatives should be used. Castor oil is perhaps of all others the best; but a combination of the colocynth pill with hyoscyamus and a small proportion of opium often answers remarkably well. Under the agony of a fit of stone, the warm hip-bath, heat applied in various other ways, hot opiate fomentations, and anodynes in suppository and injection, are our chief means of relief. Considerable benefit has also been obtained from a clyster, composed of half an ounce of oil of turpentine mixed with yolk of egg, and diffused in a pint of thin warm starch.

Long before the chemical nature of calculi was accurately ascertained, physicians conjectured that they might be dissolved while in the body, by means of internal medicines; and the opinion was supported by the great and speedy alleviation of suffering which calculous patients often derived from alkaline remedies: hence the belief became general, and various nostrums were offered to the public as certain solvents of the stone. The most celebrated of these was the alkaline solvent of Mrs. Steevens, who obtained from the British Parliament five thousand pounds for the publication of its ingredients. As both alkalies and acids, when thrown into the stomach, are found to make their appearance in the urine, they are without doubt fitted to produce some alteration in calculi within the bladder; but their action in most instances seems to be exceedingly limited. When alkaline lixivia have been long persevered in, they seem to have had the effect of rendering calculi very brittle, (Dr. *Henry*, Lond. Med. Chir. Trans. vol. x.) and in some instances to have caused exfoliations of their superficial laminæ. On examining the bladder of Horace Walpole, who had taken lime-water and soap for nine years, with great relief, some exfoliations from two of the calculi were observed. (Philos. Trans. vol. l. p. 206.)

Dr. Marcet also gives a similar testimony, regarding a case where alkalies had been used with benefit for ten years. (*Marcet* on Calculous Diseases, p. 151.) In a case which fell under our own observation, where the fixed alkalies had long been employed, the patient passed many fragments of concentric layers of calculus, which were soluble in liquor potassæ; and he was for some years before his death, which occurred at an advanced age, nearly free from urinary irritation. When the alkalies have been exhibited for a considerable time in a case of lithic calculus, a superficial admixture of the phosphates with the acid is found to have taken place; and when this treatment is continued still longer, the whole surface has been found coated over with the same salts. In one instance related by Sir Everard Home, (On the Diseases of the Prostate Gland, vol. ii.) where the alkalies had been followed after a time by an aggravation of symptoms, the stone, when extracted, was found beset with spicular crystals of the triple phosphate. The relief from the irritation of calculus procured by the employment of alkaline remedies has in some instances been so great, as to lead to the belief that solution of the stone had actually taken place; but on dissection it has been found that the prostate gland was enlarged, and the calculus lying in the cavity behind it, and thus prevented from falling against the sensitive orifice of the bladder. In the administration of the alkalies, it must ever be kept in view, that the tendency of all calculous cases is towards the formation of the phosphatic diathesis, and that the employment of the alkalies will necessarily hasten the period of its occurrence; when the phosphates will be deposited in abundance, and the calculus will receive a more rapid increase than before. A vigilant attention, therefore, is required to prevent the establishment of this diathesis, which will readily be accomplished by abandoning the use of alkalies, and having recourse for a time to acids. A phosphatic diathesis thus artificially induced, is, without doubt, much more manageable, and the probable result far less dangerous, than when it arises in the natural progress of disease, and in connection with an impaired constitution.

[In France, the Vichy waters, which are highly alkaline, have been celebrated, and their properties have been canvassed by scientific observers, whose opinions are worthy of all attention. It would not appear, that the destruction of calculi by this water is effected merely, or perhaps principally, in the way of solution, but that it is accomplished in a very considerable degree,—especially as regards those of the triple phosphates,—by a kind of disintegration of their component particles. When calculi consist of the oxalate or the phosphate of lime, mingled with lithic acid, lithate of ammonia, or the triple phosphate, the Vichy water is said to attack and disintegrate them rapidly. This water contains a large amount of pure carbonic acid, and nearly a drachm and a half of the bicarbonate of soda in every thousand drachms of the menstruum. (See the writer's *Practice of Medicine*, edit. cit. ii. 86.)]

Proposals have been made to dissolve calculi by injecting appropriate fluids into the bladder; but the trials hitherto made with alkaline solutions have shown that the bladder will not bear them of sufficient strength to act effectively on calculi of lithic acid. On the other hand, loose concretions and amorphous deposits of the phosphates, and of carbonate of lime, appear, from some late experiments of Mr. [Sir B.] Brodie, to be capable of being gradually removed from the bladder by a weak solution of nitric acid, sent in a stream through that organ, by means of a double catheter of pure gold. (London Medical Gazette, June 18, 1831.) This prospect is highly gratifying, and we trust the practice will prove as successful as the most sanguine can anticipate; but it must be remembered that cases of this description are in general complicated with such derangement in the general health, and so much disease of the bladder, that nothing beyond a palliation of symptoms can be looked for.

[Mr. S. Elliot Hoskins (*Proceedings of the Royal Society of London*, No. 56,) has endeavoured to discover some chemical agent which is more energetic in its action on certain varieties of human calculi, and less irritating when injected into the bladder. With this view he suggests the employment of weak solutions of some of the vegetable supersalts of lead, such as the supermalate, the saccharate, the lactate, &c.; but he gives the preference to an acid saccharate—the nitro-saccharate of lead. This salt must be moistened with a few drops of acetic or of its own proper acid, previous to solution in water; and the decomposing liquid should not exceed in strength one grain of the salt to each fluidounce of water. The chemical effects of these decomponents Mr. Hoskins has tried out of the body, and the results are certainly encouraging. More recently, Dr. A. Ure has suggested an injection of carbonate of lithia; and, as urate of lithia is the most soluble salt which the uric acid forms, it has been thought by him an advisable injection in cases of the lithic acid calculus. Dr. Ure has not, however, tried it: moreover, the carbonate of lithia is extremely scarce; but he suggests the importance of its preparation to the pharmaceutical chemist.]

In all cases of calculus in the bladder, the patient experiences most ease when there is a plentiful secretion of urine, which, by distending the bladder, prevents the stone from being grasped in the muscular contractions of this organ. It also probably preserves in solution what might otherwise form a new deposit on the stone; and therefore a free use of thin demulcent liquids, as barley water, arrow-root, gruel, decoctions of prunes and raisins, and of the fibrous roots of the leek, are often productive of great relief to the calculous patient. But this system of dilution is obviously not adapted to all cases; for, as we remarked above, the phosphatic diathesis is not unfrequently attended with a superabundant secretion of urine; and in such cases any increase of the quantity would still prove more distressing.

Although we cannot remove a stone from the bladder by the internal administration of drugs, surgery has invented various methods by which this object may be accomplished. The most ancient is that of cutting into the bladder, and extracting the stone through the incision; and to this the name of lithotomy has been given. The mortality from this operation has always been considerable, and uniformly very great in the hands of the inexperienced and unskilful. The proportion of deaths to recoveries has varied exceedingly in different hospitals; but it is gratifying to be enabled to state that, over the island generally, it has of late manifestly diminished; a result which we are inclined to ascribe to the more general diffusion of surgical skill. In the Norwich and Norfolk Hospital, the total rate of mortality in all ages and sexes, from the opening of the institution in 1772, has been only 1 in 7·29. Dr. Yelloly, who has made this statement, (Philos. Trans. 1829,) adds, that of late it has been reduced to 1 in 8.6. The following tables, constructed by Dr. Yelloly, (Philos. Trans. 1829,) from the records of the hospital up to June 1828, exhibit the comparative results of lithotomy at different ages and in the two sexes. The data here are more extensive, and the success is greater, than in any other British hospital.

TABLE I.

Age or Sex.	Operations.	Cured.	Died.	Mortality.
Both sexes..........	649	560	89	1 in 7·29
Males	618	531	87	1 in 7·1
Females............	31	29	2	1 in 15·5
Both sexes.				
Under 14	292	272	20	1 in 14·6
14 and upwards.....	357	288	69	1 in 5·17
14 to 40	155	140	15	1 in 10·33
40 and upwards.....	202	148	54	1 in 3·74
14 to 50	196	171	25	1 in 7·84
50 and upwards.....	161	117	44	1 in 3·56
Under 16	317	294	23	1 in 13·78
16 and upwards.....	332	266	66	1 in 5·03

TABLE II.

Age.	Operations.	Cured.	Died.	Mortality.
Infancy to 10	255	237	18	1 in 14·16
10 to 14.............	37	35	2	1 in 18·5
14 to 20.............	62	55	7	1 in 8·85
20 to 30.............	47	42	5	1 in 9·4
30 to 40.............	46	43	3	1 in 15·33
40 to 50.............	41	31	10	1 in 4.1
50 to 60.............	92	69	23	1 in 4
60 to 70.............	63	43	20	1 in 3·15
70 to 80.............	6	5	1	1 in 6

These tables present several results deserving of particular notice. The rate of mortality between the ages of 30 and 40 is only 1 in 15·33, while the decade immediately above gives 1 in 9·4, and that below 1 in 4·1. Hence it may be inferred that this small proportion of deaths is an accidental anomaly, which will not be found to correspond with the results of a more extended experience. In respect to the rate of mortality in the two sexes, and before and after puberty, Dr. Yelloly's tables coincide completely with the general observation of medical men. The mortality in males is more than double what it is in females; and the mortality before puberty is very much less than at any period after that age. The operation of lithotomy in females is now almost wholly superseded by the process of dilatation, which may be said to be wholly without danger; therefore, if in future calculations the results of the total cases of lithotomy do not appear proportionally more fatal than at present, it will obviously amount to a real diminution of deaths. The low rate of mortality before puberty is chiefly to be ascribed to the facility of reaching the bladder, owing to the small depth of the perineum, and to the imperfect development of the parts; which are greatly less vascular and less sensitive than after that age. Therefore it may be safely assumed as a rule, that whenever a calculus is ascertained to exist in the bladder, at almost any age before puberty, lithotomy ought to be performed as soon as convenient. A disordered state of the health, unless the bladder or kidneys be actually ulcerated, forms no sufficient objection; for we have known the lateral operation performed on an infant of two years and a quarter, though in a sickly and very feeble state, with the effect of speedily restoring him to sound health. The operation by being delayed becomes, after puberty, one of increased difficulty and danger; and a long train of suffering is inflicted on the patient, while organic changes are taking place in the urinary organs which will ultimately render any operation altogether nugatory. It would seem as if the operation of lithotomy often produced a change in the constitution, for it is rare that the disease is known to recur after the extraction of a calculus. This has been remarked by different writers, and particularly by the late Mr. Martineau of Norwich, a very distinguished lithotomist. He observes that scarcely a case occurs in which the complaint returns; and when a second operation has been required, he believes that it may generally be traced to the stone having been broken, and a fragment left in the bladder. (Medico-Chirurg. Trans. vol. xi. p. 413.) The propriety of performing lithotomy at a more advanced period of life admits of more question. Its difficulties and dangers are greatly increased. Many circumstances may then render it unwise to put life in hazard by an operation; and the patient has arrived at those years when he may be supposed likely to pursue with steadiness that plan of regimen and medicine which will render his sufferings more tolerable, and, in all probability, prevent the increase of the stone. So soon, however, as the phosphoric diathesis is fairly established, whatever be the period of life, medicine and regimen become of uncertain efficacy, even in the hands of the most skilful; and extraction of the calculus affords the only prospect of permanent relief to the patient.

A second method of removing calculi from the bladder is by detrition, or what has been named lithotrity; in which the stone is seized by an instrument introduced through the urethra, excavated and crushed, and the debris washed out of the bladder by injections and the natural flow of the urine. The first attempt of this nature was made by Colonel Martin, of the Indian army, who introduced an exceedingly delicate saw through a canula into the bladder, and wore down a calculus which it contained. Some years after this, Mr. Elderton invented an instrument for the same purpose; and more lately M. Civiale, M. Leroy, and the Baron Heurteloup have carried the plan into effective practice by a variety of ingenious instruments, and succeeded completely by this method in removing stones from the bladder. The number of cases to which lithotrity can be applied is very limited; for the bladder and prostate gland must be healthy, and the patient of a very tolerant temperament, to admit of its being carried into operation. The principal evils which are apt to attend this mode of procedure are, inflammation of the bladder, and retention of small fragments of the stone, which may at no distant period renew the disease.

A third method of removing calculi from the bladder is the dilatation of the urethra; but it is limited excepting for small stones, to female cases; to which it is now ascertained to be so perfectly suited, that it has in a manner wholly superseded in that sex the operation of lithotomy. It is worthy of remark that dilatation of the female urethra for this purpose is an operation as old as Franco and Fabricius Hildanus, and that it was practised with great success by Proby, of Dublin, in 1693. (See Dr. Molineux in Philos. Trans. abridged, vol. iii.)

Prostatal Calculi.—Calculi in the prostate gland very often remain for a great length of time without causing any irritation, and in that case it is much better not to disturb the patients by attempts to extract them; but should they give trouble, the usual methods of allaying irritation of the bladder ought to be had recourse to, and surgical aid called in. The forceps of Sir Astley Cooper has often been used with success; at other times such calculi have been extracted by incisions made through the rectum or through the perineum.

W. CUMIN.

[CANCER. (See SCIRRHUS.)]

CARDIALGIA. (See GASTRODYNIA.)

CARDITIS. (See PERICARDITIS.)

CATALEPSY, (derived from the Greek καταλάμβανω, to seize,) is applied to a very rare form of disease, characterized by the sudden suspension of consciousness and of voluntary motion, the muscles continuing steadily in that state of contraction in which they happened to be at the instant of the attack,—and yet readily admitting of, and retaining any other position of the body and limbs, however inconvenient, in which they may be placed at the will of the by-standers.

The extreme rarity of this affection has caused its existence to be doubted by several distinguished physicians, and amongst these, by Cullen, as he never happened to meet with any instances of it which were not feigned. There are now, however, a sufficient number of well-authenticated cases on record to render its existence unquestionable.

The attack is sometimes announced by certain precursory symptoms, as lassitude, palpitation, headach, confusion of intellect, stiffness in the neck, or pain and slight cramps in the limbs; but more generally it is instantaneous, the sudden rigidity of the trunk and limbs, the suspension of the senses, and temporary interruption of the exercise of the intellectual faculties, having been preceded by no premonitory stage. The patient retains the posture of body and the expression of countenance which he chanced to have at the moment of seizure; and by this combination of fixed attitude and unvarying expression, presents the air of a statue rather than that of an animated being. The eyes continue either fixedly open or shut, as they happened to be at the commencement; whilst the pupil, though usually dilated, contracts on the approach of a strong light. The balance between the flexor and extensor muscles is so perfect, that any new position given to the head, trunk, or extremities, by an external force, is easily received and steadily maintained. This passive energy of the muscular system, permitting the body to be moulded into almost as great a variety of attitudes as if it were a figure of wax or lead, is the distinguishing characteristic of the disease.

Catalepsy is an intermittent disorder, unaccompanied by fever, and recurring in paroxysms of various duration; more generally of only a few minutes, but occasionally of several hours, or even days. The length of the intervals is equally liable to variation, and seems to depend in a great degree on the recurrence of the peculiar exciting causes.

The return to the natural state is usually rapid, almost instantaneous, accompanied by heavy sighing, and generally by a complete restitution of all the faculties both of body and mind. Occasionally, however, pain and confusion of head, with a sense of fatigue in the limbs, are felt for some time after. There is no recollection of any thing which occurred during the fit, and the half-finished phrase which was cut short by the seizure, has been said to be taken up and completed on the instant of recovery.

During the paroxysm the countenance is for the most part little altered, though it has in some cases been slightly suffused, indicating, along with the more forcible pulsation in the carotid arteries, an increased determination of blood to the brain; whilst in other cases, on the contrary, the face has been observed even paler than natural. But these irregularities in the circulation, as well as frequent inequalities in the distribution of the animal heat, are in a manner common to all nervous affections. The respiration and action of the heart are often little affected, though in some cases the former has been observed to be much embarrassed from the extension of the spasmodic state to the muscles concerned in inspiration; and the pulse has occasionally manifested a considerable deviation from its natural force and frequency, more usually tending to an increased quickness and diminished strength.

Such is *true catalepsy*. But the disease does not always appear in so perfect a form: more frequently, indeed, its attacks are of a partial nature, the senses not being altogether obliterated, and the individual continuing conscious of every thing passing around him, though utterly unable either to move or to speak. This is the *catochus* of most nosologists. Of this spurious or partial catalepsy a very remarkable instance is recorded in Duncan's Medical Commentaries, vol. x. A woman was on the point of being buried alive in a trance, and endured all the horrors of seeing her own body prepared for interment; for though in the perfect possession of all her senses, she was unable to move a muscle or give the slightest indication of life. Galen has recorded a similar instance of total loss of the power of voluntary motion, whilst the consciousness continued unimpaired: and the author of the *Philosophy of Sleep* endured in his own person an apparently similar affection, to which he has given the title of *day-mare*. In another class of cases, the patients, having still a certain degree of consciousness, are able to move one hand or limb, and to swallow food when put into their mouths.

Ecstacy is a disease nearly allied to, and by some authors treated of under the head of epilepsy; and so often do these disorders run into one another, that of those nosologists who have separated them, no two agree on their diagnostic signs. According to Dr. Mason Good, ecstacy is sufficiently distinguished by the inflexible rigidity of the muscles, whilst consciousness, as in catalepsy, is for the most part suspended. An instance of this kind occurs in the first volume of the Medical Observations, in the case of a woman of fifty, who was daily seized, for some years, with a rigid contraction of all the muscles of the body, and such a profound sleep that nothing could awaken her: she remained thus from sun-rise to sun-set, and then recovered, took her food, and continued awake all the night, but relapsed again into the same state every morning. The greater number of systematic writers, however, place the distinguishing characteristics of ecstacy in a high degree of mental excitement, co-existing with a state of unconsciousness to all surrounding objects, the limbs being often quite relaxed. The fit is for the most part induced by deep and long-sustained contemplation of some subject capable of awakening an exalted enthusiasm; and during its continuance the patient often speaks with earnestness, prays with fervour, or sings with much pathos and expression. Vivid dreams or visions of an extraordinary nature occasionally occur, and are so firmly impressed on the memory that they can be minutely detailed afterwards. But there is much reason to suspect that a majority of these latter cases have been counterfeited. Dr. Chisholm has recorded a remarkable and apparently genuine instance in a young female, where ecstacy alternated with mania; the limbs becoming relaxed, and the patient beginning to sing in a most touching manner as often as the maniacal state recurred. To us, catalepsy and ecstacy seem to be mere modifications of the same morbid state: thus Sauvages gives a case in which the first part of the paroxysm consisted in violent declamation and gesticulation, and loud singing, the girl being quite insensible to external objects; whilst in its termination, the fit had all the characters of true catalepsy.

As to the danger of catalepsy, though we have the high authority of Boerhaave for estimating it fatally, yet subsequent and more numerous observations prove that death during the fit is a rare occurrence; and where such a termination has ensued, it has usually been from the affection being complicated with or passing into other diseases, as apoplexy, mania, &c. Rostan met with one fatal case where inflammation of the lung coexisted, and Pinel another which terminated in apoplexy. Forestus has been cited by Sprengel, in his History of Medicine, as an authority for instances of fatal catalepsy attacking simultaneously a great number of soldiers at the siege of Metz; but any one who reads his narrative must feel satisfied that both Forestus and Sprengel have fallen into error in applying the term to such cases, and that the sudden deaths attended with rigidity were simply the result of intense cold in their exposed night quarters. Forestus in a subsequent passage particularizes the case of a horseman, who being frozen to death on the saddle, continued to maintain his seat, and rode, statue-like, into the camp, still firmly grasping the reins and his weapon. He supposes that in such cases the cold merely predisposed to catalepsy, and that the maintenance of the erect posture and the firm contraction of the muscles, were sufficient evidences of remaining vitality; but this is evidently a gratuitous assumption. It was probably from such cases as these that Hoffmann came to the strange conclusion, that as catalepsy occurred most frequently in winter, it must depend on congelation of the nervous fluid.

Amongst the predisposing causes are, a highly nervous temperament, and whatever tends to increase the susceptibility of the nervous system. Of this nature are all such causes as are calculated directly to weaken the body, or to act powerfully on the mind; the depressing passions, as violent sorrow, continued anxiety, unrequited love; intense and long-sustained application of mind. Both sexes, and children as well as adults, have afforded instances of it; but females, and especially those who have a tendency to hysteria and hypochondriacism, melancholia or mania, are the most frequent subjects of these attacks. The late Dr. Gooch met with an exquisitely marked case of catalepsy supervening to puerperal melancholia, in a female debilitated by repeated miscarriages. The trunk, as she lay in bed, being raised to an obtuse angle, retained this painful posture; the limbs remained in any position in which they were placed: when set on her feet, the slightest push threw her off her balance, and no effort was made to regain it. The eyes were open, and the pupil, though dilated, contracted on the approach of a strong light. Of these attacks she had three, each lasting several hours, and recurring at the intervals of one and two days. The case afterwards resumed the form of melancholia and terminated favourably. This, which is one of the latest, best authenticated, and accurately detailed cases of the disease on record, is delineated with all the graphic power for which this distinguished physician was remarkable.

To the head of exciting causes may be referred strong mental emotions, as terror, suppressed rage, protracted meditation on deeply exciting subjects, &c. Fernelius mentions the case of a student who was seized whilst at his desk, and continued during the fit, with his pen in his hand, and in a fixed attitude of intense application. Bonetus gives the case of a soldier, who having deserted his colours, on being apprehended shortly afterwards, was so terrified that he lost the power of speech, became as immoveable as a statue, and apparently unconscious of every thing around him: after continuing in this senseless state twenty days, during which he took no food, nor had any natural evacuation, he expired.

General plethora, suppressed evacuations, repelled eruptions, worms, and other sources of irritation in the digestive organs, are reckoned among the occasional causes of this disease.

The paroxysm is sometimes induced by very trifling circumstances, as a sudden noise, a slight contradiction, an unexpected visit, or a passing fit of anger or impatience.

Catalepsy is closely allied to the comatose diseases, apoplexy, carus, lethargy; and accordingly we find it classed by Cullen under the order Comata, genus apoplexia cataleptica. To epilepsy also, it is nearly related, as we find this disorder occasionally assuming the cataleptic form, or the diseases alternating.

But in far the greater number of authentic and fully detailed cases, catalepsy has appeared to bear the strongest affinity to hysteria; and, indeed, in some of these seems to have been merely one of the innumerable forms of this Protean disorder. In support of this view we find that females and hypochondriacs are by far the most frequent subjects of both these affections; that they occur in similar constitutions, viz., those characterized by a high degree of nervous mobility; that they are convertible into each other; and finally, that they are susceptible of relief from similar modes of treatment.

In illustration of this opinion we shall briefly mention a case of catalepsy, which we witnessed some years since. The patient, a young woman of eighteen years, having been cruelly treated by a man who was under promise of marriage to her, and received a slight wound in the head and some bruises in the breast, was seized with severe and repeated fits of catalepsy. These were usually preceded by headach, vertigo, and tinnitus aurium. During the continuance of the paroxysm she remained perfectly insensible to surrounding objects; the breathing was considerably affected, and the pulse rather quick and small; the pupils were dilated, the face assumed the expression of a smile; and the limbs steadily maintained any position in which they were placed. The duration of the fits was from five to ten minutes, and they recurred very frequently in the course of the day. After each attack, pain in the præcordia, headach, and a general sense of uneasiness were complained of. In the intervals the intellectual functions were usually unimpaired, though on some occasions a slight degree of stupor was observable. After the disease had existed some weeks, the fits were occasionally accompanied with screaming and struggling. She now suffered from severe lancinating pain at the epigastrium, increased by pressure, and accompanied with difficulty of respiration, pain in the small of the back and in the right lumbar region, and subsequently some difficulty in voiding the urine, and frequent constipation. The most usual appearance of the paroxysms now became that of sound sleep, and their recurrence was much more frequent. The menstrual flux was not interrupted. The fits daily assumed more and more of the hysterical form; and by the use of aperients, local and general bleeding, and counter-irritants to the spine, ceased altogether in about two months from the commencement of her illness. The transition from well-marked catalepsy into hysteria was so remarkable in this case, as to leave little doubt of the close affinity, if not the identity, of the two diseases. The case of Helena Renault, recorded by Sauvages, seems to have partaken of the nature of catalepsy, hysteria, and epilepsy conjointly—all ceased on the spontaneous return of the menses.

One of the most remarkable cases given by M. Petetin in his treatise on catalepsy, if it be at all worthy of credit, would seem to fall rather under the head of animal magnetism, or lucid somnambulism, than true catalepsy. He asserts, not merely that consciousness and the power of voluntary motion were abolished, but that the functions of the senses were transplanted into the epigastrium and into the extremities of the fingers and toes; so that when objects of taste, smell, &c. were applied to these parts, they were as accurately appreciated as they would have been by the tongue, the nose, &c. in the natural state. Strange to say, these and some still more startling facts do not rest solely on the authority of M. Petetin; he is supported in his assertions by other and equally respectable testimony.

Diagnosis.—The diagnosis of catalepsy from asphyxia, syncope, apoplexy, and apparent death, usually presents little difficulty. The suspension of the circulation and respiration, the flexibility of the limbs, and the colour of the face or lips, sufficiently distinguish asphyxia; while syncope is readily recognised by the three former circumstances co-existing with paleness of the countenance. In apoplexy there is usually paralysis of one side of the body and flexibility of the limbs, whilst stertorous breathing and congestion of the face are common attendants. To discriminate between catalepsy and apparent death is often a matter of less facility, and more than one case is on record in which individuals in the state of trance have narrowly escaped being buried alive. In such instances the disease must have existed in a very intense form, and been accompanied with paleness, suppression of the pulse, weak respiration, and a cold skin; and here the stiffness of the limbs might be very readily mistaken for that rigidity of the muscles which characterizes the dead body. But as the pulse and respiration are never quite extinct in catalepsy, the use of the stethoscope to the region of the heart, or even the application of the finger over the seat of any of the larger arteries, will enable us to detect the one; whilst the exploration of the lungs by the same instrument, and the holding of a polished mirror over the mouth of the patient, so as to intercept and condense the pulmonary exhalation, will leave us in little doubt as to the existence of the other. The expression of the eyes and of the whole physiognomy might perhaps occasionally afford us additional assistance, as would also a knowledge of the previous state of the health, the mode of attack, and other circumstances of the case. If, after all, there shall still remain even the shadow of a doubt, we must wait for the indubitable evidence of incipient putrefaction.

Numerous instances of a state in some degree resembling catalepsy having been feigned, are on record, some of which have resisted the infliction of the severest modes of investigation. One of these stood out against the shower bath, electricity, and a variety of other energetic kinds of treatment, but was detected by the pulse of the individual being found to rise, when a proposal for applying the actual cautery was made within his hearing. Another young soldier resisted measures of still greater severity, such as the thrusting of pins under his finger-nails, scalping and trephining the head, &c. and persisted in the deception till he obtained his discharge; immediately after which he was seen in perfect health, and engaged in active occupations about his father's house. John Hunter, as Mr. Abernethy used to relate in his lectures, proposed to detect cases of feigned catalepsy by appending a weight to the arm, and after some time suddenly cutting the string by which it was attached: if any resiliency of the limb took place, he considered it a proof that additional force had been voluntarily exerted for the sustaining of the additional weight, and that, consequently, the powers of the mind were not really suspended. But even this would scarcely be conclusive, as it seems to leave the natural elasticity of the muscles altogether out of the account. Indeed, after making all due allowance for what practice and a firm determination can effect, we much doubt whether the peculiar state of the muscular system which exists in perfect catalepsy could by any effort of the will be successfully counterfeited, or whether very painful postures of the trunks and limbs could be long supported without the occurrence of such a tremor in the muscles as would reveal the deceit. And accordingly we find that impostors rarely attempt an imitation of perfect catalepsy, but content themselves with the easier task of assuming a state of profound insensibility coupled with relaxation of the muscles.

Morbid anatomy has hitherto thrown little or no light on the nature of this curious affection. As it is rarely fatal, few opportunities of dissecting such cases have occurred; and in those few, though the brain and nervous system have been carefully examined, no morbid changes have for the most part been discovered. Still, if we are to adopt the axiom of some modern French pathologists, namely, that every change of action implies a change of structure, we should conclude that such morbid alterations, though inappreciable by our senses, must needs exist. In science, however, such dogmatical assertions, with nothing but vague analogy for their support, are misplaced. The converse of the proposition, or that change of structure necessarily implies a previous change of action, might be maintained with at least an equal show of reason. The great truth that the nervous system generally gives the initiative both to disorder and disease, has of late years been too much lost sight of. The younger Pinel has attributed the symptoms to an inflammation of the spinal marrow; but this does not rest on a sufficient basis of observation to entitle it to much credit; nor, indeed, is it probable, *à priori*, that an affection, the attacks of which commence and terminate so instantaneously, and which have been known to recur at various intervals during a period of many years, should have inflammation for their cause. A temporary state of irritation and congestion of the cerebro-spinal system, would seem to be more consistent with some of the phenomena, and to give an equally satisfactory explanation of the remainder. As the disease seems to be often induced by sympathy with the stomach, intestines, or uterus, the ganglionic system is probably also not unfrequently implicated.

As to those theories which propose to explain the singular symptoms of catalepsy by a supposed excess, deficiency, or immobility of the nervous fluid, though supported by the authority of high names, they are surely unworthy of notice in the present state of physiological science. We know little of the mode of action of the nervous system, and still less of its irregularities: a candid confession of ignorance in such a case is infinitely more favourable to the advancement of knowledge than the reproduction of such gratuitous hypotheses.

In the treatment of this disease the chief indications are, to subdue general plethora when it exists, by venesection and other depletions, and to obviate irregular determination of blood to the brain and spinal chord, by the use of leeches or cupping in the neighbourhood of these important organs; or (as some continental practitioners, guided by the old theory of derivation, prefer,) to a more distant part, as the feet or thighs. The existence of headach, confusion of ideas, and flushing of the face; or of pain, and tenderness on pressure in the course of the spine, will leave us little doubt as to the propriety of these measures. Counter-irritation in the form of blisters, issues, or moxa will subsequently be called for.

The state of the stomach, bowels, and liver must be carefully investigated, and every effort made to counteract any irregularity in their functions. From the well-known influence which these organs exert over the nervous system through the medium of sympathy, the importance of this part of the treatment cannot be too much insisted on; but generally speaking, our object should rather be to keep up the natural action of the alimentary canal, than to stimulate it to excessive secretion by drastic medicines, as the local irritation and the constitutional exhaustion induced by such means would, in many cases, tend to exasperate the nervous symptoms. The existence of general plethora will, however, justify the use of free and long-continued catharsis; and Dr. Cheyne, in his valuable work on Comatose Diseases, has signalized the utility of aloetic purgatives in such cases.

A careful examination must also be made into the state of the uterine functions, and if not duly performed, every measure taken to restore them to their natural state. In those cases partaking largely of the nature of hysteria, the operation of cupping over the loins or the occiput, along with large turpentine enemata, should not be neglected.

In the intervals of the fits, exercise, diversified amusement, country air, and a mild diet should be insisted on. Sauvages records instances of the disease being removed by a milk diet and country air alone.

In those cases which appear to be purely nervous, the cold shower bath, if not peculiarly disagreeable to the feelings of the patient, and tonics, should be tried. But above all things the undue excitement of the feelings and of the intellect must be cautiously avoided.

During the paroxysm, the application of cold, in the form of ice or evaporating lotions, to the head, provided there be any proof of determination to the brain, and the immersion of the feet into a warm stimulating foot-bath, are perhaps the only measures we should put in practice. Valerian, ammonia, musk, assafœtida, and other antispasmodics, both in draughts and enemata, are usually employed, with the view either of warding off or shortening the duration of the fit, but generally with no very marked advantage.

The older writers recommend ligatures to the limbs; and assiduous friction with stimulant liniments; but if the seat of the disease be, as we have every reason to believe, in the brain or spinal chord, little can be expected from such means. Electricity and galvanism have also been suggested, and are said in some instances to have cut short the attack. In the Dictionnaire des Sciences Médicales, it is recommended to direct all our efforts to rousing the dormant sensibility of some one organ; and a case is given from the *Ephemerid. Naturæ Curios.* where this was done with success: but the mode of effecting it there alluded to is one which, we believe, few practitioners in this country would venture to recommend. M. Petroz has occasionally known music to exercise a singular influence over the paroxysm, diminishing it materially both as to duration and intensity.

Should the attack end in apparent death, the importance of the immediate employment of artificial respiration is obvious; and indeed, in any of these cases where the action of the heart and lungs is greatly depressed, we should not be justified in neglecting it. In similar circumstances the application of moderate warmth and the free access of pure air are of the highest moment.

W. B. Joy.

CATAMENIA. (See Menstruation. See also Amenorrhœa, Dysmenorrhœa, Menorrhagia.)

CATARRH, Pulmonary.—Every disorder of the mucous membrane of the bronchi has been included under this name. Thus Laennec makes the term generic, applied to the several species, *the mucous* (acute and chronic), *the suffocative, the pituitous, the dry*, and *the convulsive catarrhs.* But as the etymology of the word (κατὰ, *deorsum*, ῥέω. *fluo*,) has relation rather to the secretion than to the pathological state of the diseased membrane itself, it is better to reserve the term for those forms of the disease in which unnatural secretion is the only constant or appreciable phenomenon. We have accordingly included under the head bronchitis all those affections of the bronchial membranes which are in any appreciable degree inflammatory, except hooping-cough, which will be found in its place. The cases, therefore, excluded from that head that require consideration under the name of catarrh, are those which Laennec denominates the *pituitous* and the *dry catarrh*, and this rather from want of another term, than from the aptness of the term employed.

Both the pituitous and the dry catarrhs attack the nasal as well as the pulmonary mucous membrane, and, like the inflammatory influenza, frequently pass from one to the other. According to the extent of the membrane affected, they may amount to a very trivial or a very serious malady; and when they affect extensively the bronchial membrane, they constitute the disease in a great number of the cases which are commonly called asthmatic.

1. Pituitous Catarrh.—This form of catarrh is distinguished by the secretion of a thin, colourless, glairy liquid from the bronchial membrane. This flux comes on in paroxysms, attended with dyspnœa and cough, which are relieved by the expectoration of a liquid, "frothy on the surface, and underneath like the white of egg diluted with water." Such a secretion frequently attends bronchitis when it attacks persons of lax habit of body; and, in fact, those cases which have been called *pneumonia notha* seem to owe their peculiar character to the pituitous secretion that occurs in them. It is sometimes likewise present in cases of œdema of the lungs, and the first stage of phthisis. It does occur also idiopathically, and as such we have to consider it here. It is either acute or chronic. In its acute form it sometimes commences as a common cold, but with a sensation of oppression and dyspnœ greatly disproportioned to the slight febrile symptoms. The attacks are sometimes of short duration, passing off entirely in the course of a few hours, after the expectoration of a quantity of the fluid before described, which sometimes amounts to several pints. Not unfrequently they assume a periodic character, coming on twice or three times a day, the symptoms in the intervals generally disappearing entirely. Sometimes this affection is combined or alternated with what Laennec terms dry catarrh, and the tough pearly mucus characterizing the latter is often seen in the expectorated matter. The stethoscope discovers a variety of sibilant and bubbling rhonchi in the chest, often resembling the chirping of birds, whilst during the paroxysm the sound of respiration is impaired. The chest sounds well on percussion. During the intervals the same rhonchi are present, but in a much slighter degree, and the respiratory sound resumes its distinct character. The examination of those who have died during a paroxysm of pituitous catarrh discovers little or no trace of inflammation in the bronchial membrane. It is sometimes a little thickened and softer than natural, from the infiltration of serum; often perfectly pale; and any blushes or striæ of red that may occasionally appear are very slight, and of trifling extent. These circumstances, and the fact that it attacks most commonly those of weakly habit, languid circulation, and little disposed to inflammatory symptoms, seem to indicate that it is rather of the nature of a *profluvium*, arising from want of tone in the vessels, than an inflammation. The effects of remedies and the nature of the predisposing causes confirm this supposition. It most commonly arises in persons who have for a long time suffered from disordered digestion, whether arising from habits of excess, or from natural weakness of the digestive powers. In certain individuals a form of pituitous catarrh sometimes happens during the summer months, and it is commonly attributed to an inhalation of the effluvia of hay-fields, whence it has gained the name of hay-fever or hay-asthma; but this is apparently more of the nature of influenza. After one attack, pituitous catarrh is extremely apt to recur; alterations of temperature or irregularities of diet being sufficient to re-excite it. When it has once established itself, like most other serous fluxes, it is very difficult to remove; for the habit of occasional profuse secretion being acquired, it frequently does not yield on the removal of the original exciting causes. Laennec remarks, that it is common in gouty subjects advanced in age, and in whom the gout has become milder and

less regular. The importance of pituitous catarrh varies much according to the state of the individual whom it attacks. When it seizes a subject enfeebled by present or previous disease, it may prove fatal in a few hours. Again, its long continuance, when it has by habit become established in the system, sometimes wastes the body, and brings on disease of the heart, pulmonary œdema, or some other loss of balance among the vital functions, that leads to the extinction of life.

In other instances, where the body is strong, or the disease slight, it may go on for years, injuring the comfort rather than the general health of persons even far advanced in life. Andral records an instance in which a sudden and temporary attack of pituitous catarrh, with very profuse discharge, was attended with the removal of a hydrothorax. We have before remarked that it sometimes is excited by miliary tubercles in the tissue of the lungs; and in all cases where the constitution of the subject, irregular resonance of the chest on percussion, with bronchophony, and constancy of cough and pituitous expectoration (not in paroxysms), indicate this lesion, the prognosis must be more unfavourable.

The treatment of pituitous catarrh must be considered in relation to the paroxysms, and likewise to the disposition to them. The indications during the paroxysm are to facilitate the removal of the redundant secretion, and to prevent its further effusion. The means which we employ under the name of expectorants, have probably, in some instances, both these effects, but in a very uncertain degree, and rarely in a manner available in these cases. Ipecacuanha, whether as an emetic, or in a nauseating dose, is perhaps the one from which most advantage has been derived. It is best to obtain at first its emetic effect, and afterwards to repeat it in such quantities as will keep up a slight sensation of nausea. The power which this remedy has in restraining hemorrhages is probably of the same character which renders it useful here: but it is extremely difficult to say whether this is from any direct action on the affected vessels, or from its general effects on the circulation. Tartar emetic, in large doses, which Laennec found effectual in two cases of an alarming aspect, probably has a similar mode of action; and from what we know of its effects in peripneumony, it seems difficult to avoid attributing it to a sorbefacient power. The lobelia inflata would perhaps more properly than these come under the class of expectorants. Of its utility in pituitous catarrh we have the testimony of practitioners of great sagacity and experience. The tincture has been given in doses of fifteen or twenty-five minims every two or three hours, with marked effect in relieving the dyspnœa. As has already been remarked, (see Chronic Bronchitis,) it is a medicine that must be watched, and stopped or diminished if vertigo or nausea show that its effect on the system has been produced.

Of evacuants, which it may be necessary to resort to, to divert the determination from the pulmonary vessels, those which produce watery discharge are to be preferred to bleeding, which is seldom admissible, and only where there is marked plethora of the system. Diaphoretics and diuretics, if they can be brought to act, will have a tendency to shorten the paroxysm. Antimony and ipecacuanha, as already recommended, will best fulfil the first effect, and squill may be used with advantage as a diuretic. Drastic purgatives are not generally useful, often injurious; but those of a milder kind may be given with advantage; and when irregularities of diet have been the exciting cause of the paroxysm, a free evacuation of the bowels may contribute most materially to its removal.

In many cases these means are of but little avail; and when they do abridge or remove a paroxysm, they are scarcely effectual enough to prevent its recurrence. Strengthening the system by a mild but tonic regimen, removing disorder of the digestive organs, and the adoption of every means calculated to improve the general health and strength, often succeed better in curing pituitous catarrh than any remedy directed against the disease itself. The diet should be mild and nutritive, consisting chiefly of farinaceous food and plain meat. The hours of eating should be regular, and the quantity moderate. All spirituous and fermented liquors are best avoided, and liquids of all kinds should be taken sparingly. Coffee made by infusion is the best beverage, and seems positively useful in some cases in preventing the recurrence of the paroxysm. To strengthen the digestive powers, calumba, rhubarb, or some other bitter may be given; and in some cases the sulphate of quinine, with a mineral acid, will be found of good effect. But the safest and most efficacious tonics, are country air of a bracing quality, such as that of Brighton, and the cold shower or plunge bath. Regular exercise is highly necessary; and that on horseback is generally the most suitable. It is of importance to attend to the clothing, that it be sufficient to prevent the cuticular exhalation from being checked by occasional winds.

2. Dry Catarrh.—This disease is more recognised as an asthmatic than a catarrhal affection. In fact, the term catarrh is not by any means appropriate in a disorder that is unattended with flux; and but for the absolute want of another term, it should not be employed. The pathological state of the membrane, however, does not so much differ, as the nature of the secretion, from that in the disease just described. There appears to be a passive or venous congestion in the mucous membrane of the bronchi, which neither in its nature nor effects resembles inflammation. An improved nomenclature, founded on pathology, is much to be desired; but it may be doubted whether it be expedient to frame one until our knowledge of pathology itself be much more extended and definite than at present.

The symptoms of dry catarrh vary much according to its extent. In its slightest degrees it occurs in those individuals who, without any other derangement of health than a slight shortness of breath felt on exertion, expectorate every morning a small portion of tough mucus of a pearl grey colour. Sometimes, however, there are cough and dyspnœa, which, coming on in paroxysms, assume the form of asthma, each fit terminating with an expectoration of pellets of the same dense mucus. Occasionally there is a tolerably copious pituitous secretion at the same time; but this is uncertain, and bears no relation to the severity of the preceding fit, which seems to be connected with the formation of the thick mucus. Sometimes there is little or no cough; and the dyspnœa, or rather shortness of breath, may continue for months, or even years, without other symptoms. If an attack of bronchitis supervene, there is generally an aggravation of the dyspnœa, sometimes amounting to a fit of asthma. Laennec, who is the only writer who has given a distinct account of this disease, remarks, that it most commonly attacks gouty persons, those affected with cutaneous eruptions, and those disordered by long excesses; and he considers the slight and dry coughs frequently attendant on various functional disorders of the abdominal viscera, and which are generally called nervous, to arise from a degree of dry catarrh.

The physical sign of this disease is a suspension of the sound of respiration in the part affected, while the corresponding part of the chest sounds well on percussion. This arises from a tumefaction of the bronchial membrane, which either of itself, or assisted by the pellets of thick mucus before described, more or less completely obstructs the caliber of one or more of the tubes. When the obstruction is not complete, a dull whistling or clicking sound accompanies the breathing; and a cough or forcible inspiration may sometimes discover the same sounds where in ordinary breathing the air does not enter. According to the extent of the bronchi thus affected, the severity of the disease will vary; but in all cases the expectoration of the thick mucus brings with it some relief of the dyspnœa. Andral records two cases in which a fatal asphyxia was caused by such obstructions occurring in one of the great bronchi, and which no efforts of coughing were able to remove; but these are to be considered as accidental rather than as common cases.

On anatomical examination, the membrane of the bronchi affected is found tumefied, and of dull red or violet colour, but without softening or ulceration. These circumstances, together with its duration, seem to indicate this affection, although occasionally originating in inflammation, to be of the nature of passive congestion, with interrupted secretion. Although not frequently in itself a dangerous disease, dry catarrh often much aggravates the symptoms of any other affection attacking the chest; and is in itself apt to induce the organic change called emphysema of the lungs.

The congestion of the mucous membrane constituting dry catarrh, chiefly occurs, like other congestions, in those persons in whom some functional derangement has injured the balance of the circulation, and impaired the tone of the extreme vessels. Disordered digestion, imperfect secretion of the bile, and irregular alvine excretion, are the most common of these derangements; and, although they do not always give notable and direct evidence of their existence, the success attending treatment calculated to remove them is so efficacious in relieving the affection in question, that it should be adopted in all severe cases of dry catarrh. It is unnecessary here to particularize the treatment alluded to; but it may be observed that a proper regulation of the diet, to the exclusion of rich, irritating, or acescent articles of food, and all fermented liquors; the promoting regular alvine evacuations of proper colour by the aid of small doses of blue pill and ipecacuanha, followed by castor oil, saline, or other mild aperients; and afterwards giving tone to the stomach and system by a judicious administration of tonics;—all these measures, as the circumstances may require, may be resorted to with the greatest advantage, and are often more successful in the permanent relief of the dyspnœa or asthma of dry catarrh than any measures directed against the disorder itself.

Laennec remarks that the means found useful in chronic bronchitis and other forms of catarrh, make no impression on this, and are only indicated when any of these are combined with it. The indications are, to remove the congested state of the bronchial membrane, and to facilitate the expectoration of the dense portions of mucus that obstruct the tubes. Bloodletting, blisters, and evacuants in general, have not the effect on congestion that they have on inflammation; and the state of the system is generally not such as to make the trivial benefit that may result from them equivalent to their weakening effect; but the same objection cannot be urged against dry cupping, which Laennec recommends; and friction of the chest with rubefacient substances, the occasional short application of a blister, wearing a pitch-plaister, or any of those means that may excite the superficial circulation without weakening the system, may be resorted to in most instances with more or less temporary relief.

With these measures we may properly combine such expectorant medicines as may fulfil the second indication, namely, to facilitate the expectoration of the thick mucus, which by obstructing the bronchial tubes becomes a principal cause of the dyspnœa. As Laennec remarks, we may effect this by any means which will diminish the glutinous tenacity of this matter; and he conceives that we possess medicines capable of attenuating the secretions and rendering them more liquid, in the mild or very dilute alkalies. He recommends either almond soap, in form of pills, with the patient's meals, to the amount of ʒss. to ʒi. a day, or the carbonated alkalies in doses of from twelve to thirty-six grains. He likewise made use of baths, both salt water and alkaline, made with four ounces of a carbonated alkali. He considered sulphur baths serviceable in cases complicated with herpetic diseases. To the efficacy of alkaline medicines in dry catarrh we can add our testimony. We have already spoken of their utility in other bronchial affections besides these accompanied by a viscid secretion. But in these their effect is more marked and unequivocal, and far from being so inexplicable as Laennec seems to consider it. The power of alkalies and acids to change the quality of the urine is well ascertained; and whether it be by an effect on the whole mass of blood, or by the agent passing immediately to the kidneys, it is quite certain that an acid or an alkaline quality may at pleasure be communicated to the urine by repeated doses of the corresponding medicine given by the mouth. Now it is not indulging a supposition too chemical, to consider that the formation of thick tough mucus is incompatible with an alkaline state of the fluids, since alkalies exert a remarkable solvent power on mucus. Then it must be held in view, that the beneficial effects of alkalies are not limited to the removal of the viscid secretion; but by likewise establishing a liquid secretion from the diseased membrane, they tend very much to relieve the congested state of its vessels. To increase this effect, it is advantageous to combine with the alkalies, squill, ammoniacum, or some other stimulating expectorant. The liquor potassæ is the form of alkali to which we give the preference; and we have found ten minims or more, with the same quantity of tincture of squills and ʒss of the tinct. camphoræ comp. in ℥i of water, of more efficacy than any other combination in dry catarrh. Where languor of the circulation and tendency to spasmodic asthma are present, a preference may be given to combinations of ammonia and ammoniacum; and if the liquor potassæ should ever appear to irritate the stomach, castile soap, as recommended by Laennec, may be substituted. Inhalation of the vapour of water, alone, or with camphor or some other aromatic matter, would probably avail more here than in other cases of pulmonary catarrh; but we have no experience on this point. Finally, we must again insist on the importance of attending to the state of the other functions, and do all in our power to remove the disposition to local congestions, by keeping free the secretions, and giving tone to the body by cold baths, frictions, and regular exercise.

C. J. B. Williams.

CATHARTICS. By cathartics are meant substances which accelerate the peristaltic movement of the intestinal canal, and promote the evacuation of its contents. They operate locally on the intestines; but their influence is extended to the neighbouring viscera, and, in many instances, to the whole system. When their action is confined to the intestinal canal, they prove beneficial by restoring its natural function. Their stimulus is often extended to the stomach, causing its contents to be propelled into the duodenum; and they promote and increase the flow of bile and of the pancreatic fluid, by stimulating the excretory ducts of the pancreas and the liver.

The kidneys, the bladder, and the uterus, are also influenced by the action of cathartics; the secretion of the first is generally diminished by their continued exhibition, as the fluids which they cause to be discharged by the bowels would have been excreted by the kidneys. The uterus suffers by contiguity.

Cathartics differ with respect to the part of the canal on which they act: some particularly stimulate the duodenum, promoting the discharge of the bile through the biliary ducts; as, for instance, calomel and jalap; others, as aloës, exert their action on the colon and rectum; while a third class, the saline and oleaginous purgatives, increase the peristaltic movement of the whole intestinal tube, and therefore operate quickly. No satisfactory explanation of the cause of this difference of action has yet been advanced; but the knowledge of the fact is of great importance in a practical point of view.

Cathartics are said to act *generally*, when, besides the evacutions of the bowels, they also cause a copious discharge of serous fluid from the general circulating mass: the suddenness of this abstraction, combined with the quantity of the fluid discharged from the exhalents, produces a powerfully sedative effect on the whole frame: the force and velocity of the pulse are lessened; excitement is diminished, and febrile and inflammatory action is overcome, or, at least, greatly lessened. In some instances, indeed, as when elaterium is administered, the discharge of watery fluid is so excessive, that alarming and even fatal effects have resulted. If purging be long continued, the chyle is evacuated; and hence, in protracted diarrhœa, the blood loses its red colour, the surface of the body becomes pallid, and symptoms of exhaustion supervene.

Cathartics excite the general action of the absorbents, and on this principle is explained the removal of extravasated fluids: even solid matters, the product of disease, are sometimes removed by active purging; an effect attributable to a law of the system, by which a great discharge of serum is followed by a corresponding increased action of the absorbents.

Some cathartics cause purging when they are only applied to the skin; thus, if a cataplasm of rhubarb be laid upon the pit of the stomach of a child, the bowels will be emptied; and aloës, applied to any abraded surface, produce the same effect on the rectum as if the medicine had been taken into the stomach, This may be taken advantage of when patients obstinately refuse to swallow medicines, as occasionally occurs in childhood, and frequently in insanity. On the same principle, placing two or more drops of croton oil on the tongue purges briskly, when the powers of deglutition are suspended, and injections do not fulfil the intention of the practitioner.

Although the *primary* influence of cathartics, that of exciting the alimentary canal, is shared by all of them, yet they differ considerably in their *secondary* effects. Some operate quickly; others very slowly: some produce nausea, griping, and tenesmus; others operate with little sensible impression: some cause one copious evacuation only; others repeated stools. The doses, also, in which cathartics are administered, greatly modify their action: some, when given in large doses, only slightly increase the peristaltic motion of the bowels; others, when given in minute doses, produce numerous watery stools with great irritation; and some act so violently as occasionally to excite inflammation. Cathartics have been accordingly divided into laxatives, purgatives, and drastic cathartics.

1. **Laxatives** are partially digestible substances, which gently stimulate the inner coat of the intestinal tube, and moderately quicken the peristaltic action. They merely remove irritating matters from the bowels, and thereby diminish what is termed the tension of the system, and abate the disposition to febrile action; they are on this account employed in cases in which active purging would prove detrimental. Some laxatives owe their effects to a mechanical property; as, for example, bread made of flour which has not been bolted or freed from all the bran, proves aperient, owing to the little spiculæ of the horny

testa of the grain which have been left in the flour. The distension of the stomach by a large quantity of fluid is often followed by evacuation of the bowels. But many laxatives owe nothing to their physical properties: this is the case with manna, sugar, honey, the pulp of the cassia fistularis, the juice of ripe subacid fruits, malted grain, fermented liquors, bland fixed oils, sulphur, magnesia and subcarbonate of magnesia, and some other substances.

2. **Purgatives** are indigestible substances, which, taken into the stomach, or introduced into the rectum, irritate the coats of the intestines and augment their peristaltic movement. The action of purgatives is, therefore, merely an increased degree of that of laxatives; but besides augmenting the peristaltic action of the intestinal canal, they stimulate their secreting surfaces, so that an increased quantity of fluid is secreted by the intestinal exhalents.

The necessity of employing purgatives is founded on the same circumstances which demand the use of laxatives; and as their operation also reduces the powers of the system, they are indicated in diseases of excitement, in which the mere evacuation of the alimentary contents is a secondary consideration. In continued torpor of the bowels, giving rise to an accumulation of fæces in the larger intestines, more active stimulants than simple laxatives are requisite; and hence in such cases purgatives are employed.

Purgatives are procured both from the organic and the inorganic kingdoms of nature. Among those belonging to the first are classed substances the effects of which depend, — 1. on an *acrid principle* blended with a fixed oil, as in castor oil; 2. on a *stimulant volatile oil* combined with resin, as in the balsam of copaiba, and the various turpentines; 3. on *resin* in union with *extractive*, as in jalap, rhubarb, and aloës; or with cathartine, as in senna leaves; or veratria with fecula, as in colchicum. Among the inorganic purgatives, the most active are, 1. compounds of the oxides of metals combined with different acids, constituting salts; for instance, sulphate of magnesia; the sulphate and the phosphate of soda; the tartrate of soda and potassa; the sulphate, bisulphate, tartrate, bitartrate, and acetate of potassa: 2. oxides of metals in combination with vegetable matter, as in the mercurial pill, or with magnesia, or with chalk, as in the preparations termed, hydrargyrum cum magnesia, and hydrargyrum cum creta: 3. chlorides, as that of soda, and the submuriate of mercury.

3. **Drastic Cathartics** are also indigestible substances, which operate in the same manner as purgatives, but with greater energy, and affect the nerves of sensation more than either laxatives or purgatives; frequently causing griping, or tormina, nausea, and vomiting. This influence, however, on the sensitive nerves is not essential to the fulfilment of the intention for which drastic cathartics are administered. Drastic cathartics are chiefly derived from the organic kingdom of nature, and consist generally of resinous and resino-extractive matters: for example, scammony, colocynth, gratiola, gamboge, white hellebore root, croton oil, the root of the common dock, rumex *obtusifolium*, tobacco, and elaterium. One drastic purgative only, the precipitative sulphuret of antimony, is derived from the inorganic kingdom.

Although cathartics have been described as belonging to three genera, yet it is impossible to mark the limits where the one set terminates and the other commences; for all, with a few exceptions, may be arranged under one head, the difference depending rather on the energy of their action than on any specific or peculiar mode of operation. The effects, indeed, of cathartics, depend on such a variety of circumstances, that laxatives may operate in some cases with violence, and a mild and scarcely sensible action may follow the administration of the most drastic cathartics. What are the circumstances that thus so powerfully modify the operation of this order of medicines?

We may first mention *quantity* as modifying the operation of cathartics; and this is so obvious as scarcely to require any comment. The rule, however, is not general; as some drastic purgatives, for example, elaterium and croton oil, exert their full influence in such minute doses that it is impossible to reduce their action to that of a laxative. On the other hand, some laxatives, as sugar, manna, and magnesia, cannot, in any dose, be brought to operate as drastic cathartics. The second circumstance influencing the operation of cathartics is *mechanical division*. The resinous purgatives, when coarsely powdered, cause griping and even tenesmus; while, in a state of more subtile division, they operate with little sensible effect; a circumstance at variance with the law which regulates the degree of action of most other substances. Thus, if camphor be combined with colocynth, the purgative property of the gum resin is increased; but at the same time its influence on the sentient nerves is greatly diminished: and the same effect is produced by the union of camphor with senna. By such a combination, the colocynth is rendered more soluble; but in the case of the senna, the activity of which is augmented even when the camphor is added to the decoction, some other explanation must be sought for. The third circumstance modifying the powers of some cathartics is *light*, operating on impalpable powders. Thus, if powdered rhubarb be kept in a glass bottle, the portion on the side of the bottle exposed to the light loses both its colour and its activity, while that on the opposite side retains both unaltered. The last circumstance which we shall notice as influencing the operation of cathartics is *combination*. Thus in cases of spasm, the operation of a cathartic is promoted by its combination with opium; and under all circumstances, mixture,— as for example, the mixture of sulphate of magnesia and bitartrate of potassa, of infusion of senna and camphor mixture, and compounds of the resinous cathartics and camphor, and the union of calomel with jalap, scammony, gamboge, colocynth, or rhubarb, — promote the action of purgatives, and cause cathartic substances to operate with more certainty than when taken alone.

Cathartics differ in the time necessary for the production of their effects; some operating in a few hours, others requiring from eight to twelve. These differences depend, in some degree, on the solubility of the substances in the fluids of the alimentary canal. Thus the saline purgatives operate most quickly; the resinous require the longest time. It is probable also that their action in different parts of the intestinal canal, is, in part, to be ascribed to their different degrees of solubility. Some, as jalap, are very soluble in the fluids of the duodenum, and act immediately on that portion of the canal; others dissolve more slowly, and act on the lower intestines; whilst others, as, for instance, calomel, acquire activity from meeting with acid in the stomach and undergoing a chemical change. This rule, however, is not without exceptions: thus aloës is more soluble than jalap, yet it operates chiefly on the colon and rectum; and even when applied to an ulcer on the surface, its influence is still exerted on the large intestines. A knowledge of the time required for the operation of different cathartics is useful in a practical point of view, as it enables us to adapt our remedy to the urgency of the case: the saline purgatives, owing to the rapidity of their operation, are well adapted to acute diseases, especially those of a febrile and inflammatory character; the resinous, from the tardiness of their action, are better calculated for chronic affections.

Cathartics differ in their ultimate effects upon the system. In general they induce a subsequent costiveness; and this is supposed to depend on the evacuation of the fluids of the intestines being so considerable, that some time is requisite to replace them; but it is more probable that it is the result of that law of the constitution which determines that every increased action must be followed by a state of inactivity or collapse. The more general, also, the action of a purgative, the more likely is costiveness to follow: an exception, however, must be made, as relates to castor oil, which, when given daily, operates in such a manner, that the dose may be gradually reduced to a few drops, and yet the effect of a full dose be maintained. Saline purgatives, owing to their operation on the whole intestinal canal, often leave a greater sluggishness of the bowels than existed before their exhibition. Rhubarb, also, has this effect: but on the contrary, those resinous cathartics which operate on the lower portion of the canal, induce a more open state of bowels.

In the administration of cathartics, some attention must be paid to the following circumstances:

1. Cathartics are more necessary and serviceable in warm than in cold climates; owing, not only to the greater vitiation of the contents of the bowels and the augmented secretion of bile in high than in low temperatures; but to the great determination of fluids to the skin in warm climates favouring the formation of scybala. As to the influence of season, it is an old maxim that purgatives should be given in the spring and autumn: and it is true that more inflammatory diseases prevail at those seasons than at other periods of the year; but the custom ought not to be followed by persons in health, as it is apt to nduce a habit which may prove hurtful.

2. The constitution of the patient must be ttended to. Cathartics are more required by ersons of a melancholic than those of a sanguine temperament, the bowels being generally more torpid in the former than the latter. There is an exception, however, to this rule in women, who, although they are more commonly of a sanguine temperament, yet are generally more disposed to costiveness than men; they do not however bear the operation of purgatives so well. In pregnancy, and during menstruation, drastic purgatives should not be administered, nor should cathartics of any kind be freely employed in states of debility. In attending to this rule, however, it must be recollected that debility may arise from very opposite conditions of the system. Where any idiosyncrasy exists, connected with the operation of cathartics, it should not be disregarded, as much injury may follow the employment of certain kinds of purgatives in such instances: thus, in some individuals a dose of rhubarb will cause convulsions closely resembling those of epilepsy; in others the smallest quantity of calomel will produce alarming syncope. The readiness with which ptyalism is induced in some individuals by the last-mentioned medicine is also a circumstance which sometimes requires consideration.

3. Although a costive state of body is to be strictly guarded against in childhood, yet it is certain that children bear the action of cathartics worse than adults. On account of the depressing effects of saline purgatives, those of a warm character are the best adapted for aged persons.

4. Cathartics ought not to be too frequently taken, as, by the excitement they produce in the mouths of the hepatic and pancreatic ducts, they cause a hasty, irregular, and imperfect secretion of bile and pancreatic juice, which is highly injurious to the digestive function.

5. As a general rule, cathartics are inadmissible in inflammatory states of the alimentary canal which have gone on to ulceration.

6. The nature of a cathartic determines the period of the day in which it should be administered: if it require a long time to operate, it should be given at bed-time; if it act quickly, in the morning: thus saline purgatives, senna, castor-oil, croton-oil, and elaterium, are best administered in the morning; the gum resins, sulphur, and calomel, in the evening. But the action of a cathartic may at any time be quickened by copious dilution with warm aqueous fluids.

7. During the operation of a purgative, it is necessary to distinguish carefully those appearances of the alvine discharges which are the results of disease from those produced by the cathartic. Calomel always causes the evacuations to appear unnatural; and, if it be requisite to ascertain their real aspect, the use of the medicine must be suspended for a few days. During the operation of colchicum the stools are of a bilious appearance; during that of full doses of saline purgatives, daily repeated, they assume a peculiar colour; and the effect of elaterium is to produce stools resembling water in which meat has been partially boiled.

With respect to the peculiar action of cathartics, it is necessary to make a few remarks.

Among the laxatives, honey is apt to gripe and to prove flatulent, and the older it is the more likely are these effects to follow its administration. Cassia-pulp, which is now seldom employed alone in this country, produces nausea, flatulence, and griping. Tamarind-pulp, although an agreeable laxative, yet operates too gently to render it useful when given alone; it is, therefore, usually combined with neutral salts. The same observation applies to manna. Olive-oil operates as a mild laxative in doses of f.℥ii. Sulphur, whether in the simple sublimed state, (the sulphur lotum of the pharmacopœiæ,) or in that of a hydrate, (sulphur præcipitatum,) is a mild but certain laxative, well adapted to cases of habitual dyspnœa, in which it is of much importance to keep the bowels open: and in hemorrhoids it is preferable to purgatives, not only on account of the mildness of its operation, but because it produces soft, easily moulded stools, which pass from the rectum without irritating the highly sensitive piles. It may be given daily, in doses of from ʒss. to ʒiss., combined with gr. x. or gr. xv. of magnesia, until its odour is manifested on the skin, when its employment should be intermitted for a few days. Magnesia and its carbonate operate with some degree of energy when they meet with much acid in the stomach. The pure magnesia is usually preferred to the carbonate, on account of the inconvenience produced by the extrication of the carbonic acid of the latter in the stomach. Both of them, when they do not act freely as laxatives, are apt to accumulate, and form concretions in the stomach, if taken daily for some length of time; hence, in such cases, it is proper occasionally to clear out the bowels by means of a brisk cathartic. Magnesia, besides exercising its laxative influence, allays the irritability of the stomach; it is consequently useful in the dentition of infants and children, at which periods of life there is both much irritability, and a prevailing acescency of the stomach. The dose of the magnesia is from gr. xv. to ℈ii. for an adult; that of the carbonate from ℈i. to ʒi.: when it is taken alone, the best vehicle is milk.

Among the purgatives no animal substances are found; and the vegetable products, although they may be in some degree digestible substances, are not dietetical. They may be noticed according to their effects. Castor-oil, which seems to be intermediate between fixed and volatile oil, owes its properties to an acrid principle which is obtained, mingled with bland oil, by the expression of the seeds of the ricinus communis, and is more or less active according to the degree of temperature employed in the process; that now generally employed is expressed in India without heat. From its quick and mild operation it is peculiarly adapted for children, puerperal women, and all cases in which it is necessary to procure the evacuations with little constitutional disturbance. As its effects are not influenced by combining it with opium, it is generally preferred to other purgatives in colica pictonum and calculous affections. None of the purgatives can be so much relied upon for overcoming habitual costiveness as castor-oil, given daily for some weeks, gradually reducing the dose until less than half a teaspoonful be taken; after which the bowels generally continue to act without farther artificial assistance; even its occasional administration leaves the bowels in a relaxed state. The tendency of castor-oil to nauseate is a disadvantage, but it is counteracted by the addition of an aromatic. The dose for an adult, to produce a full operation, is from f.ʒiv. to f.℥iss.

The terebinthinate purgatives, for example the balsams, as they are incorrectly termed, of copaiba and of Gilead, common turpentine, Chian turpentine, and Canada balsam, are stimulant in proportion to the extent of the dose. In doses of f.ʒi., rubbed into an emulsion with mucilage of gum, balsam of copaiba affords much relief in hemorrhoids; and owing to the determination which it induces to the kidneys, acts in some respects as a counter-irritant. It may be administered in the form of pills, by mixing it with one-sixteenth of its weight of calcined magnesia, and exposing this mixture to the air until it acquires a consistence fit for forming it into pills. The other turpentines are most commonly exhibited in the form of enema, in torpid conditions of the bowels, and in the sinking stage of some febrile diseases, particularly in erysipelas of a malignant kind. Under such circumstances the dose is from f.ʒi. to f.ʒiv., rubbed up with mucilage and manna. In some habits the turpentines are apt to cause an eruption on the skin, closely resembling eczema; in which case their use should be discontinued.

The resinous purgatives, jalap, aloës, and rhubarb, operate variously according to circumstances of extent of dose, combination, and the state of the patient. In a moderate dose, for instance, from gr. xii. to ʒss. of the powder, jalap operates effectually without griping; in larger doses it gripes, and produces copious watery stools; and when given in an over-dose it excites hazardous inflammation of the mucous membranes. It operates chiefly through the medium of the nervous system; for when it is injected into the veins it does not act on the bowels, although when it is combined with lard and rubbed on the skin it causes brisk purging. The fineness or coarseness of the powder, also, modifies the operation of jalap; and it is probable that its augmented activity, when united with bitartrate of potassa and other neutral salts, is in part owing to the aid which they afford to its comminution. In conjunction with calomel, the activity of jalap is increased, owing to the calomel aiding its stimulant influence on the hepatic duct in the duodenum. The watery extract operates mildly, and is on that account well adapted to children; the resinous extract gripes violently and displays all the characters of a drastic cathartic without purging much. With respect to the state of the patient—in nervous and irritable habits jalap operates too violently; whereas in languid and torpid individuals its purgative influence requires to be aided by other cathartics. Jalap is chiefly useful as a general purgative in febrile affections connected with an increased action of the liver, and a more than natural discharge of vitiated bile into the duodenum.

Aloës is a warm stimulating purgative, exerting little action on the duodenum and small intestines, but affecting powerfully the colon and rectum, a peculiarity which has been erroneously attributed to the little solubility of the aloës in the fluids of the intestinal canal permitting it to pass nearly through its whole length before it is sufficiently dissolved to exert its purgative influence.

In small doses, for instance from g. v. to gr. x., aloës does not induce an attack of hemorrhois, which, however, is not an unfrequent result of large doses. It has been found useful in the dyspeptic affections of cold and languid habits, particularly of the sedentary and hypochondriacal. In combination with calomel or blue pill, or with alkalies, it has been found more beneficial in jaundice than when given alone, notwithstanding the opinion of Cullen, (Materia Medica,) that nothing is obtained by combining aloës with other substances. From the influence of aloës on the rectum it is generally thought to be an improper medicine in pregnancy; but Dr. Denman has remarked that the lower class of people use aloës on account of the cheapness of the medicine, and because it can be conveniently administered in the form of pills without any bad effects in such cases. (Introduction to the Practice of Midwifery.) The addition of camphor to aloës renders its operation both milder and more certain.

Rhubarb is one of the most useful of the resinous purgatives, acting chiefly through the medium of the nervous system, a fact demonstrated by the effects of its application in the form of cataplasm to the surface; for were it absorbed, the colouring matter would be detected in the urine, which is not the case; yet the application of such a cataplasm purges briskly.

Senna owes its purgative property to a peculiar principle, discovered by MM. Lassaigne and Feneulle, called *cathartina.* This principle is dissolved by water at a temperature of 96°, which takes up little of the extractive and other matters on which the griping quality of senna is supposed to depend; an infusion, therefore, made with distilled water at this temperature, purges without griping. When the infusion is kept ready-made and exposed to the air, the cathartina is decomposed and the extractive oxidized. Senna is a useful and very general purgative, there being scarcely any disease in which purgation is indicated, where it may not be administered. The purgative power of the infusion is greatly augmented by the addition of camphor mixture, or of the decoction of guaiacum: it is seldom given alone; but some of the adjuncts frequently prescribed with it, such, for example, as magnesia, rhubarb, and the carbonates of alkalies, destroy its active properties.

Notwithstanding the virulent effects of colchicum when given in an over-dose, it is an efficacious and valuable purgative; operating chiefly on the duodenum, and, by stimulating the excretory ducts of the liver and the pancreas, producing copious bilious stools; diminishing febrile action, and allaying pain. To these effects we may ascribe the beneficial influence of colchicum in gout and rheumatism. It may be demanded, why do not other purgatives equally relieve these diseases? We reply,—present us with one that will act as decidedly on the hepatic and pancreatic ducts, and we will equally rely on its powers. The wine is the best form of the medicine, because the acetic acid in it is sufficient, in conjunction with the alcohol, to take up the whole of the veratria, and is not enough to determine its action chiefly to the kidneys, which is the effect of the vinegar of colchicum.

The inorganic purgatives are principally neutral salts. The most commonly employed of these, sulphate of magnesia, purges freely without griping; but as it frequently causes flatulence, it requires in most instances to be conjoined with aromatics, or some warm bitter infusion, such as that of cascarilla. It operates chiefly on the duodenum; and it is to its presence that many of the mineral purging springs, as those of Kilburn, Cheltenham, Moffat, Seidlitz, and others, owe their active properties.

Soda is the basis of at least three purgative salts, the phosphate, sulphate, and muriate. The phosphate, on account of its similarity to common salt, and the mildness of its operation, is well adapted to children and delicate persons: it acts moderately in doses of from ʒiv. to ℥ii. Before the introduction of the sulphate of magnesia, sulphate of soda was the most commonly employed purgative: it is now less used. Its nauseous taste is readily and effectually covered by citric or tartaric acids; and when a purgative is required to lessen rapidly the mass of the circulating fluids, none answers more effectually than a combination of three parts of sulphate of soda, and one part of bitartrate of potassa. Sea-water owes its purgative influence to a combination of muriates, of which that of soda is predominant. All the salts of soda operate upon the whole length of the intestinal canal, stimulating the orifices of the exhalent vessels, and, consequently, causing serous discharges in the form of thin watery stools: they are, therefore, well calculated for cases of febrile excitement, and those in which there is a tendency to plethora. Their influence on the exhalent vessels also promotes absorption, for the action of the exhalents cannot be augmented without a corresponding increased action of the absorbents. In prescribing the salts of magnesia and of soda, it is important to understand the variation of their action produced by various combinations. Thus, the addition of sulphate of magnesia quickens greatly the action of infusion of senna; while, for those who can scarcely bear the operation of purgatives, the sulphate should be combined with bitter or aromatic infusion, or even with sulphate of iron, as circumstances may direct; and this rule holds good, also, respecting the others.

The salts of potassa are more diversified in their action than those of magnesia and soda. The sulphate and bisulphates of potassa are useful adjuncts to rhubarb and aromatic bitters in dyspepsia, accompanied, as it usually is, with torpid bowels. The dose of the sulphate is from gr. x. to ℈ii., that of the bisulphate ʒss to ʒii. It must be recollected that the sulphate is decomposed by tartaric acid and converted into the bitartrate; hence it cannot properly be prescribed with infusions of tamarinds, nor with the infusion of senna with tamarinds of the Edinburgh Pharmacopœia. As a purgative, the neutral sulphate is supposed to extend its action beyond the intestinal canal; and, therefore, it is generally selected in cases of obstructions of the mesenteric glands. In combination with aloës, it has been found to answer well in cases of jaundice, in dyspeptic affections, and in habitual costiveness. The tartrate and bitartrate of potassa differ considerably in their mode of operation. The former is a mild and efficient purgative, operating without griping; and it has, also, the property of lessening the griping quality of senna and scammony. It acts on the whole of the intestinal tube; and, as it operates rapidly, it is well suited to cases requiring the aid of a quick and effectual purgative. The average dose is from ʒi. to ʒiv. It is perhaps the best purgative that can be prescribed, to assist the effect of a large dose of calomel given at bed-time; thus, from ʒi. to ʒii. of tartrate of potassa, in f.℥iss of infusion of senna, administered in the morning, after a dose of calomel taken on the preceding night, operates rapidly, and sweeps away the bile which the calomel has brought from the liver. The bitartrate operates more on the exhalents of the smaller intestines than the tartrate, producing watery stools, flatulence, and, in some persons, griping. From its property of acting on the exhalents, it is advantageously prescribed in cases of ascites and other dropsical accumulations; hence its continued use is productive of emaciation, and to this property, also, may be ascribed its utility in cases of plethora and obesity. As it is not very soluble, it may be given either in the form of powder or of electuary, combined with jalap, scammony, or sulphur. The acetate of potassa in small doses operates as a diuretic; but in doses of from ʒii. to ʒiv. it purges freely, if the surface of the body be kept warm. It is, nevertheless, much inferior to any of the other saline purgatives.

With respect to the mercurial oxides and salts, the mercurial or blue pill and calomel may be regarded rather as preparatives for active purgatives than as purgatives themselves; they operate chiefly by stimulating the gall-ducts, when given in full doses; and as alteratives, improving the biliary secretion and increasing it, when the liver is in a torpid state. The hydrargyrum cum creta operates also mildly; but it is seldom employed except in cases requiring the aid of a mild alterative, or as a purgative for children in whom there is much acescency of stomach, and in whom there are, at the same time, glandular obstructions. When calomel is intended to operate as a purgative, it should be given in much larger doses than are usually prescribed: in such doses, for example, as from gr. x. to gr. xv. it lessens the irritability of the stomach when this is excessive, combines with, renders more fluid, and detaches the viscid mucous secretions adhering to the small intestines, and augments the vascular and capillary circulation in the mucous coat of the colon and rectum.

During its administration it has been said that the aspect of the alvine discharges is rarely natural; the medicine should, therefore, be frequently intermitted for a few days, in order to ascertain the real state of the abdominal secretions.

The last division of cathartics, the *drastic purgatives*, consist, almost entirely, of organic products, involving some very active principle. Their operation is commonly attended with griping; and in some instances the effects are so violent, that, unless they be closely watched, much mischief may result from their employment. They exert a powerful influence on the exhalents and absorbents, and merit more justly the name of hydragogues than any other set of purgatives. Amongst them, colocynth is supposed to owe its cathartic power to a peculiar principle which has been named *colocyntine;* but this is uncertain. Colocynth operates chiefly on the larger intestines; and, as with aloes, this happens even when it is applied to an ulcer on the surface of the body. When given in substance, the violence of its operation should be moderated by triturating it with gum or farinaceous matters. It is most usually administered in the form of extract, in doses of from gr. vi. to gr. xv.; but the aqueous decoction is milder in its effects than the extract. The resinous drastic purgatives most commonly employed are scammony and camboge. Scammony is a powerful griping cathartic. It is generally combined with calomel, and is one of those substances the acrimony of which is greatly modified by combining with it sulphate of potassa. From its activity, it is well adapted for removing the scybala that frequently remain, for a long time, in the cells of the colon in maniacal cases; and in combination with calomel and sulphate of potassa, it aids greatly in removing ascarides from the rectum. The dose is from gr. v. to gr. xv.; it is advisable generally to conjoin with it a drop or two of some volatile oil; and when the bowels are irritable, if it be ever proper in such a case to prescribe a drastic purgative, the watery emulsion of scammony, allowed to settle and deposite the resin, will answer the purpose, as it operates with sufficient activity without griping. Camboge is more drastic than scammony, and frequently excites vomiting when given alone, even in moderate doses. It is usual to combine it with calomel, soap, rhubarb, or sulphate of potassa. The average dose is from gr. iv. to gr. viii. The drastic character of the root of black hellebore as a cathartic was well known to the ancients, and one of their chief resources in the management of mania: but it may be doubted whether it possesses any superior advantages over other active cathartics in that disease, or even as a hydragogue. One of the most active of the drastic cathartics is, undoubtedly, the expressed oil of the seeds of the croton tiglium. Like castor oil, it is the solution of an acrid principle in a bland oil, in the proportion of forty-five parts of the former to fifty-five of the latter. The acrimony of this principle is so great, that the oil operates briskly by merely applying a single drop of it to the tongue; nevertheless it seldom excites nausea or vomiting, and rarely griping. In maniacal cases, in visceral obstructions, in dropsical accumulations, in delirium tremens, in apoplexy, and in all cases requiring ample and prompt evacuations, the oil of tiglium may be prescribed with advantage. The best mode of using it is to rub it up with sugar, as an oleo-saccharum, in the almond emulsion; or to dissolve it in alcohol, as recommended by Dr. Nimmo.

The last of this class of cathartics which it is requisite to notice is elaterium, a vegetable product, which owes its activity to *elatin*, a peculiar principle discovered by Dr. Paris,* and the most powerful purgative agent yet known, as it constitutes one-twelfth only of the weight of elaterium, of which one-eighth of a grain only is required to produce brisk purging. Elaterium, when properly managed, is an excellent drastic hydragogue. Sydenham employed it successfully in dropsy; but it fell into disrepute from the indiscreet use made of it, until Dr. Ferrier, of Manchester, restored it to practice for the cure of hydrothorax. In administering it, the strength should be supported with moderate stimuli, particularly ammonia, capsicum, or camphor: under every circumstance the utmost caution is required in its administration, and no practitioner ought to prescribe it unless he is able personally to watch its effects. The average dose to an adult is one-sixth of a grain; and this should be repeated every sixth hour, until copious stools are procured.

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* Dr. Clutterbuck first discovered the fecula now called elatin.—See his paper in the Medical Repository, quoted by Dr. Paris.—EDITORS.

Among the inorganic drastic purgatives, the only substance requiring to be noticed is the precipitated sulphuret of antimony, which, however, is employed merely as a component of the compound calomel pill. It is a violent but very uncertain cathartic.

A. T. Thomson.

CEPHALÆA, CEPHALALGIA. (See Headach.)

CHEST, Contraction of. (See Pleuritis.)

CHEST, Exploration of. — The methods employed by physicians for *exploring* or physically examining the external parts of the chest, with the view of discovering or discriminating the diseases of this cavity, are the following: — *inspection, manual examination, mensuration, auscultation, percussion, succussion.* The three latter methods have been fully discussed in the article Auscultation; it therefore only remains to notice the three former in this place.

The relationship of the external to the internal parts is much more easily ascertained in the case of the thorax than the abdomen, owing to the less complexity and greater fixedness of the contents of the former cavity. The thoracic viscera are few in number, and their boundaries are, in general, accurately defined. In the state of health they cannot vary their position; and their displacement is produced by only a small number of well-defined causes, the chief of which are preternatural growths, or the accumulation of fluids within the cavity of the chest, encroachment of the abdominal viscera from below, or alteration of the solid walls of the chest, chiefly from distortion of the spine.

In the article Exploration of the Abdomen, the importance of knowing the topographical relations of the external and internal parts of the great cavities was pointed out, and also the means of rendering this knowledge more precise by the aid of artificial subdivisions of the anterior of the body. The principles adopted in dividing the whole trunk of the body are there explained; and the figures in pages 26 and 27 exhibit a repre-

Fig. 4.

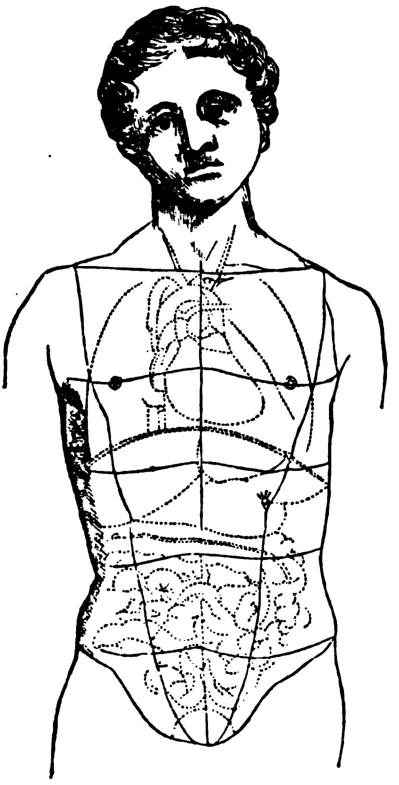


Fig. 5.

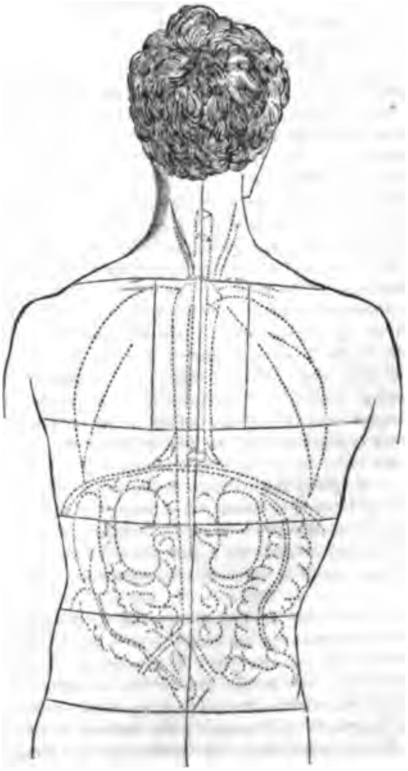
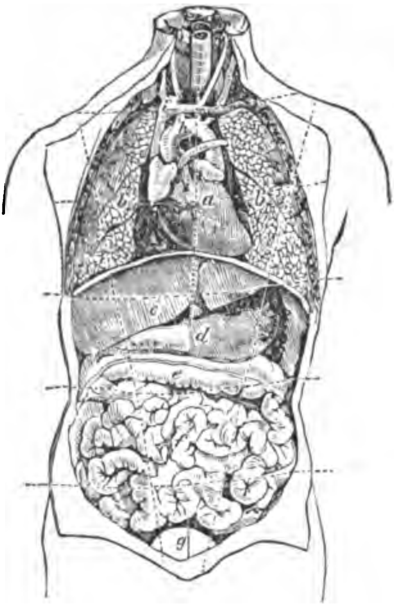


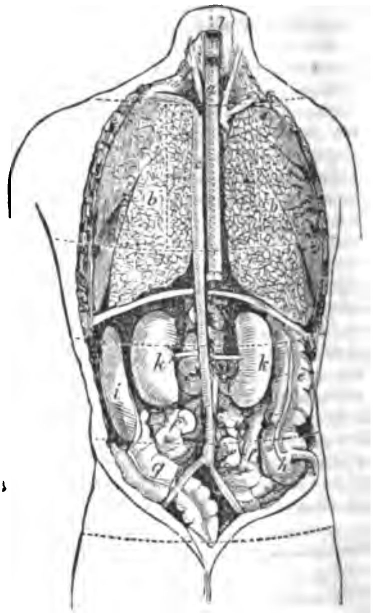
Fig. 6.



Front View.

a. The heart.
b. The lungs.
c. The liver.
d. The stomach.
e. The transverse arch of the colon.
f. The small intestines.
g. The bladder.
h. The arch of the aorta.
i. The left subclavian vein.

Fig. 7.



Back View.

a. The œsophagus.
b. The lungs.
c. The aorta.
e. The ascending colon.
f. The small intestines.
g. The descending colon.
h. The caput coli.
i. The spleen.
k. The kidney. — *l.* The trachea.

sentation of the thoracic regions along with those of the abdomen. We must, therefore, refer the reader to those figures, while we now proceed verbally to define the regions which belong exclusively to the chest.

All the regions, as is explained in the article referred to, are bounded by direct lines drawn from fixed and conspicuous points on the surface of the body, and which lines are either vertical or horizontal. The vertical lines having relation to the chest are eight in number, and run as follows:—1. along the middle of the sternum from its upper to its lower extremity; 2. from the acromial extremity of the clavicle to the external tubercle of the pubes (right and left); 3. from the posterior boundary of the axilla, or inferior edge of the latissimus dorsi, to that point of the crest of the ilium on which it falls vertically (right and left); 4. along the spinous processes of the cervical and dorsal vertebræ; 5. along the posterior or spinal border of the scapulæ, from the clavicular transverse line to the mammary transverse line. The horizontal or transverse lines are four in number, and are as follows:—1. around the lower part of the neck, sloping downwards to the upper end of the sternum anteriorly, and to the last cervical vertebra posteriorly; 2. around the upper part of the chest in the line of the clavicles; 3. around the middle of the chest, crossing the nipples anteriorly, and touching the inferior borders of the scapulæ behind; 4. around the lower part of the chest on the scyphoid cartilage.

By these imaginary lines the trunk is divided into three horizontal and eight vertical bands, and their intersections form, in all, sixteen compartments or regions, of which two are superior, four anterior, four lateral (two on each side), and six posterior. They are named as follows:—*superior regions*—humeral (right and left); *anterior regions*—subclavian (right and left), mammary (right and left); *lateral regions*—axillary (right and left), subaxillary or lateral (right and left); *posterior regions*—scapular (right and left), intrascapular (right and left), subscapular or superior dorsal (right and left).

In the figures introduced into the present article, to which we particularly call the attention of the student, an attempt has been made to impress still more strongly on the mind topographical relations of these external artificial subdivisions with the viscera within. In consequence of their introduction we shall greatly abridge the remarks on these relations which would otherwise have been necessary. In studying them it is necessary to keep constantly in view the figures in p. 27, and the explanation of the regions which accompanies them.* In fig. 4 and 5 the outlines of the viscera are delineated on the surface of the body; and in fig. 6 and 7, the regional lines of the surface are drawn on the viscera exposed in situ.

The natural boundaries of the two great organs contained in the chest scarcely require to be pointed out. Separated from each other by the mediastinum, which at its lower part includes the heart, the two lungs are in contact with the solid walls of the chest in every other point, and rest on the diaphragm below. The heart rests on the diaphragm on the left side of the sternum, and extends upwards beneath this bone midway to the upper part of the chest. Both lungs descend much lower on the sides and back than on the fore part of the chest, on account of the position of the diaphragm, which stretches upwards from behind forwards, so as to form an acute angle with the spine. The lungs are consequently prolonged downwards, in very thin lappets, behind, and reach much lower than persons not very well versed in anatomy are apt to believe. It is not unusual to find painful affections of the dorsal pleura referred to the kidneys. An opposite mistake is occasionally committed on the fore part of the body, affections of the liver and stomach being referred to the lungs or heart, because the site of the pain is considerably above the margin of the ribs. We do not allude to those sympathetic pains which in dyspectic cases radiate far within the true boundaries of the chest, but to pains fixed in the organs themselves.

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* As belonging all to the same series, we have continued the numeration of the figures begun in the former article.

The general shape of the lungs corresponds with that of the cavity in which they are placed. The right lung is larger than the left, but does not descend so low anteriorly, owing to the position of the liver on that side. The upper lobes of the lungs rise as high as the first rib and clavicle, and in the space between the last-mentioned bone and the anterior edge of the trapezius muscle the pulmonary structure is undefended by any bony or thick muscular covering, and consequently lies very near the surface.

I. *Inspection.*—By inspection of the chest we mean in this place the ocular examination of the chest freed from covering; and it is by this alone that the actual configuration of this cavity, whether natural or morbid, can be ascertained with certainty.

The relative size of the cavity of the chest varies considerably in different individuals even of the same age, sex and stature. This is a circumstance of much practical importance, more especially in relation to prognosis. A very small chest not merely predisposes to diseases of the lungs, but renders them, when they occur, more dangerous. It even tends to enfeeble the constitution generally, by diminishing the energy of the respiratory and circulatory functions, and may thereby become a source of aggravation of many diseases which have not their seat within the chest.

A well-proportioned chest should be large in all directions, more particularly in its antero-posterior and lateral directions. Sometimes we see great disproportion in this respect overlooked from imperfect examination. Generally speaking, the cavity of the chest is proportionally smaller in women than in men; and this natural conformation is commonly increased by the use of stays; often it is aggravated in an extreme and most injurious degree. The effect of stays tends to diminish the capacity of the chest chiefly in two ways; first, in its transverse diameter, by compressing it in every point towards the axis of the trunk on its lower half; and, secondly, in its vertical diameter, by forcing the diaphragm upwards before the compressed abdominal viscera. In these cases, although the longitudinal extent of the proper cavity of the chest is greatly diminished, the external bony compages of the thorax is often lengthened, the lower ribs being forced downwards towards the pelvis. When this happens, the usual topographical relations of the external and internal parts are often greatly altered; and mistakes in diagnosis are only to be prevented in such cases by careful examination of the body freed from its coverings, and by the habit of inspecting bodies, so distorted, after death. Another very frequent cause of alteration of the natural configuration of the chest in women is distortion of the spine. Every experienced practitioner is aware of the great frequency of this affection among young women educated at boarding-schools, or subjected to sedentary employments. The effects of this change in the natural direction of the spine in altering the shape of the chest are well described by many of our recent surgical writers; but they are still too imperfectly known by practitioners in general. The real nature of such cases can only be ascertained by inspection, more particularly of the back.

It is, no doubt, by inspection that we can judge most accurately of the condition of the respiratory function generally; but it is not necessary to have recourse to this expedient in order to ascertain the mere frequency or quickness of the inspirations and expirations. This we can do by merely watching the respiratory sounds; and the signs and indications thence derived for the purposes of diagnosis, prognosis, and practice, belong more to the general subject of diagnosis than to the physical exploration of the chest. But it is impossible to ascertain the degree of mobility of the whole thorax relatively with that of the abdominal parietes, or of one side of the thorax relatively with the other, without inspection; and such knowledge is often of much importance. In certain inflammatory diseases of the chest, as pleurisy, more particularly when both sides are affected, the walls of the thorax often remain nearly unmoved, respiration being carried on almost entirely by the diaphragm and abdominal muscles. In this case the abdominal movements are quick and extensive, while those of the chest are the reverse; such a condition of the respiration has been termed *abdominal.* When inflammation exists in the abdominal cavity, the thoracic parietes are preternaturally mobile, while those of the abdomen are inactive: in this state the respiration is said to be *thoracic.* It is only by inspection also that we can ascertain certain conditions of the mere surface, which are, however, often of importance to diagnosis. Of this kind are œdema of a portion of the chest, the relative width of the intercostal spaces, their degree of prominence, &c.

But it is by enabling us to ascertain partial contractions or dilatations of the chest, not dependent on spinal distortion, that inspection is most useful. In some cases, these partial alterations of shape extend to both sides, but they are much more commonly confined to one. In phthisis which has been very slow in its progress, and when tubercles exist in both lungs, as usually happens, we find both sides of the chest contracted, particularly in the subclavian regions. In asthma, on the contrary, both sides are usually considerably dilated, more particularly about the middle of the chest, and rendered much more convex both before and behind. In old asthmatics this configuration of the chest is sufficiently conspicuous, even when the body is covered. Its presence is always a proof of the permanent dilatation of the pulmonary cells, and, generally, of an incurable disease.

But the alteration of configuration produced by disease in the chest is much more generally confined to one side; and the diseases in which this change occurs are chiefly pleurisy and pneumothorax. In acute pleurisy, when the effusion is at all considerable, the affected side is perceptibly dilated; and Laennec assures us that he has often observed this effect on the second day of the disease. The eye readily detects the dilatation when it does not exceed half an inch in the whole semi-circumference of the chest. In chronic pleurisy, when the accumulation of fluid is very great, the affected side is often very considerably dilated: the disease, however, frequently exists without any dilatation. In pneumothorax the affected side is often much dilated; and here, as in simple empyema, we sometimes see the intercostal spaces elevated to the level of the ribs, or even above this. Some of the same diseases which produce dilatation of the chest, occasion at other times a contraction of it, either generally or partially. Contraction of one whole side of the chest is a frequent result of pleurisy, the side being diminished in all its dimensions, the ribs being pressed together, and the intercostal spaces consequently nearly abolished. Partial contraction or dilatation of the chest, permanent or temporary, is still more common than a similar condition of the whole side. When not dependent on distortion of the spine, it may always be regarded as a sign of disease within the chest, either now or formerly existing. By far the most common cause of partial contraction of the chest is circumscribed pleurisy. In the history of the individual diseases—phthisis, hydrothorax, pneumonia, pleurisy, empyema, pneumothorax, &c.—the significance and value of the foregoing signs will be more particularly pointed out.

II. **Manual Examination.**—There are only a few circumstances relating to the physical condition of the chest which cannot be ascertained without the direct application of the hand. Of this kind is soreness or tenderness of the surface. Much tenderness of the surface of the chest on simple touch usually indicates an affection of the external parts, either of the skin or muscles, as in the rheumatic affection termed *pleurodyne*. It is, however, sometimes produced by internal diseases, as when a collection of pus in the pleura is making its way outwards by perforation of an intercostal space. When, however, considerable pressure is made in the intercostal spaces, pain is very frequently experienced in pleuritic affections, more particularly of a chronic kind. In chronic pneumonia, also, and in phthisis, when the lungs, as frequently happens, are adherent to the costal pleura, the same effect is frequently observed: and in cases of this kind we have often found much uneasiness produced by even the gentlest percussion, more particularly if made without the pleximeter.

A preternatural degree of temperature of any part of the surface of the body has been always considered indicative of disease of the particular part, or of those which lie beneath it.* The same rule is, no doubt, equally applicable to the diseases of the chest; but although the fact may be so, it is interesting more as a pathological phenomenon than as a means of diagnosis, as it scarcely ever exists where we are not provided with more certain indications. In acute pleurisy and pneumonia, and yet more in the complication of these, pleuro-pneumonia, the external surface is often much increased in temperature; and this fact was taken advantage of by Avicenna as a means of detecting the part affected. For this purpose he proposed to apply wetted cloths upon both sides of the chest, and concluded that the side on which the cloth dried soonest, on account of the greatest heat, was that in which the inflammation existed.

Manual examination discovers the presence and degree of muscular robustness, obesity, or emaciation, also œdema, emphysema, &c. with much greater certainty and accuracy than mere inspection: it also enables us to judge of the natural degree of thickness of the thoracic parietes, a circumstance sometimes of considerable importance in appreciating the value of other signs derived from different methods of physical exploration.

[If the hand be applied to the chest whilst a healthy person is speaking, a vibratile tremor, called *vocal vibration* or *vocal fremitus*, is felt; which, at times, is scarcely or not at all perceptible, but at others is very marked, especially in those whose voice is grave. In persons with weak or shrill voices, it is absent altogether, and hence is not felt in children, and is very often absent in women. It is more marked, according to Dr. Stokes, (*On Diseases of the Chest*, p. 497; Lond. 1837,) on the right than on the left side; in front than behind; behind than laterally; is scarcely perceptible in the infra-clavicular, and still less so in the interscapular sub-regions. This fremitus is heard not only when the person speaks, but often when he coughs; rhonchi and friction sounds can also be appreciated in the same manner. (Walshe, *The Physical Diagnosis of Diseases of the Chest*, p. 16, Amer. edit.: Philad. 1843.) The writer has often been struck with the difference in the vocal fremitus of the two sides of the chest, where one lung has been affected with tubercular or other consolidation, and the other not. (See AUSCULTATION OF THE VOICE.)]

III. **Mensuration.**—This process is confined chiefly to ascertaining the comparative size of the two sides of the chest, which relation it ascertains with much greater preciseness than either of the two former methods. It consists simply in measuring the superficial extent of the chest by means of a piece of tape stretched over it from certain fixed points. As the contraction or dilatation may be in both the transverse and vertical directions, it is necessary, if we wish to be extremely precise to make two admeasurements, one from the spine to the sternum, the other from the top of the shoulder to the lowest rib. In general, however, the transverse admeasurement is all that is requisite. In measuring the two sides, we must be careful to apply our tapes in a precisely similar manner to each side. In ascertaining the transverse extent, we first make our measurements after a complete expiration, and then after a full inspiration. It will thus frequently be seen that, although little or no difference is found between the two sides in the former case, it is very considerable in the latter,—the chest on the diseased side not at all expanding during inspiration, and probably expanding even more than in the state of health on the sound side. This effect is rendered particularly striking by fixing the *middle* of the piece of tape on the spine, and allowing the two ends to rest somewhat loosely on the sternum, so as to be moved by the motions of the chest: on the patient taking a deep breath, the end on the sound side is seen gradually to recede from the sternum, while that on the diseased side either remains stationary, or recedes to a very small extent. In cases of contracted chest succeeding acute pleurisy, in which a cure has been effected, it is interesting to watch, month by month, the gradual expansion of the contracted side. In such instances we have been accustomed to supply the patient with a marked piece of tape, and have been gratified to prove by this means, at certain intervals, the progressive return of the chest to its natural size.

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* Et ubi in corpore caliditas aut frigiditas, isthic morbus est. *Hippoc.* Aph. 30, sect. 4.

[The average result of the most accurate measurements of the chests of 20 persons not labouring under disease of the lungs, gave, according to Dr. Stokes, (*op. cit.* p. 498,) for the right side 17.86 inches; and for the left 17.23, or more than half an inch in favour of the right lung. Of these, the most capacious chest measured 22 inches for the right, and 21.50 for the left. In one case only, the left side was larger than the right, and in three the sides were symmetrical. In the case in which the left side was more developed, the man was left-handed, and the biceps measured half an inch in circumference more than the right. Of 20 measurements made by the writer—ten of males and ten of females, none of them labouring under disease of the lungs, the average in the case of the males gave 17.47 inches for the right side,—16.92 inches for the left;—in that of the females, 15.2 inches for the right side, and 15.1 for the left. (*Practice of Medicine*, 2d edit., i. 390: Philad. 1844.)

The two sides of the chest are affirmed to be of unequal dimensions in about five-sixths of healthy subjects; a mean excess of about half an inch existing on the right side in right-handed individuals; whilst in left-handed persons the left side sometimes measures more, or more frequently the same as the right. (Walshe, *op. cit.*)]

It has been endeavoured to ascertain the capacity of the chest, or rather of the lungs, on another principle, namely, by ascertaining the quantity of air the lungs were capable of containing. This method was proposed by the late Mr. Abernethy. It is obvious that it does not lead to the same results as mensuration of the external surface of the chest; this latter giving the capacity of the containing, the former the capacity of the contained parts. Mr. Abernethy's method consists in making the patient take as deep an inspiration as possible, and then expire through a bent tube communicating with an inverted jar containing water. The quantity of water displaced by the air is a measure of the capacity of the lungs to contain air. A person in good health with sound lungs is able to displace six or eight pints; and if the amount be greatly less than this, as for example, only one-third or one-quarter, it may be inferred that the lungs are either obstructed by disease of their own substance, or compressed from without. "Muscular debility or spasm," says Mr. Abernethy, "may occasionally make the result of this experiment doubtful, yet in general, I believe it will afford useful information." (Essays, Part. II. p. 157.) In this judgment we agree with Mr. Abernethy.

A more simple test of the capacity of the lungs, founded on the same principle, has been proposed: (Edin. Med. Journ. vol. xxxviii. p. 453.) It consists in measuring the comparative length of time occupied in making a complete expiration after a complete inspiration. With the view of proving that the expiration is continuous, the patient is desired to *count* from one upwards, as far as he can, slowly and audibly; and the number of seconds during which he is able to count, without drawing breath, is noted by a watch: the number of seconds is considered a proportional sign of the quantity of air expired, and consequently of the lungs. Dr. Lyons, who proposes this method, says that the most healthy individual will not continue counting beyond thirty-five seconds; but in this he is certainly mistaken, as any of our long-winded readers may prove by personal experiment. In confirmed phthisis, Dr. L. says, the period of expiration never exceeds eight, and is frequently less than six seconds; while in pleurisy and pneumonia it may range from four to nine. This test is of much easier application than Mr. Abernethy's, but it is much less accurate: it is liable to variation from many causes, but still, like Mr. Abernethy's, it may be occasionally useful.

JOHN FORBES.

CHICKEN-POX.—The terms chicken-pox and swine-pox seem to have been in use in England from a very early period, to express those lighter cases of eruptive disorder, which, bearing a general resemblance to small-pox, yet differ from that disease in the mildness of the accompanying fever and the shorter duration of the eruption. Morton, the contemporary of Sydenham, introduced the term chicken-pox into scientific nomenclature, and it is now so universally adopted that it is proper to inquire what are the pathological characters of the disease thereby designated. Is the chicken-pox allied to small-pox? Does it arise from the same contagion? Does it give security against small-pox? Can it be communicated by inoculation? These questions have been argued for the last hundred years, and the opinions of pathologists are still far from being made up concerning them. It is obvious that before we can undertake to establish the diagnostic characters of chicken-pox, we must have previously fixed the distinguishing features of small-pox. On this account it is proposed to defer the regular consideration of the former until the latter disease has been described. A brief sketch, however, of the eruptions commonly known in England as the *chicken-pox*, may find a place here.

This term is familiarly applied to all those eruptive complaints, in which, after a brief attack of fever, the skin is covered, generally or partially, with vesicles or imperfect pustules, which run through their stages of maturation and decline in three, four, or, at furthest, five days, the attending constitutional symptoms being very slight, without any threatening of danger. Such disorders are very common. They are met with in infancy and mature age. They often appear to prevail epidemically. Dr. John Thomson, of Edinburgh, believes that the whole of them are modifications of small-pox, and the result of the variolous virus. Other pathologists, again, consider that under the term *chicken-pox* are included different *kinds* of disease, analogous to each other in their progress and termination, but differing in their causes and in their earlier phenomena. This latter is the opinion, which, after very careful consideration of the subject, will be adopted here. Accordingly, the reader will find under the head of Small-pox (*Modified*) a description of that class of cases which are characterised by imperfect pustulation, occurring chiefly in adults, and preceded by two or three days of fever; while under the head of Varicella Lymphatica he will look for those which have for their chief features a sudden eruption of vesicles, preceded by little or no fever, and occurring almost exclusively in the periods of infancy and childhood.

George Gregory.

[CHLOASMA. (See Ephelis.)]

CHLOROSIS, from χλωρὸς, green; the disease known by the designation *green-sickness*. This singular affection is chiefly incidental to female youth; it occurs sometimes, however, in the age of childhood, not unfrequently in married women, and occasionally in the young and delicate of the male sex; and in these several cases it assumes modified forms, which will be carefully described in the sequel.

History and Symptoms.—Chlorosis steals upon the patient very insidiously. It has pretty distinctly three stages; the incipient, the confirmed, and the inveterate. It may be characterized, in general, as uniting a morbid paleness of the complexion, tongue, and general surface, with recurrent pain of the head or of the side, generally the left; palpitation, fluttering, breathlessness, nervousness, and frequently attacks of hysteria, with some tendency to loss of flesh and œdema.

The first stage or period of chlorosis is usually little observed by the patient or friends. There is a slight paleness, or a little fading of a wonted florid complexion, and the patient is only a little more languid and listless than usual, the ordinary amusements or occupations, whether mental or bodily, being accompanied by fatigue, the nights restless, the mornings heavy. With these changes, however, there is invariably a confined state of the bowels, a deranged condition of the stomach, a tainted breath, a white and pasty tongue, and a morbid appetite; and there is recurrent headach, pain of the left side, palpitation, &c. The catamenia are supposed to flow as usual, but an attentive inquiry discovers, that with the complexion, the uterine discharges also lose their colour.

In the second or confirmed stage, every morbid appearance, every symptom is aggravated; the countenance, the prolabia, the tongue, the gums, the internal parts of the cheeks, the conjunctiva, the general surface, and especially the fingers and the finger-nails, become absolutely exanguious, sometimes with a pearly, sometimes with an icterode hue; the eye-lids are sometimes slightly œdematous, especially in the morning; the tongue, besides being pale and exanguious, is œdematous and impressed with the teeth; sometimes slightly loaded, sometimes morbidly clear, and glossy in various parts; the teeth are apt to decay; the skin becomes gradually rather dry; a singular change takes place eventually in the finger-nails, which become brittle and easily split or break off, so that frequently a pin can scarcely be taken out of the dress. An equally remarkable change is also occasionally observed in the hair, which becomes dry and harsh, frequently splitting, and not remaining "in curl;" the ankles become tumid, and more and more œdematous. With the accession and progress of these symptoms, the catamenia are found to become more and more scanty and pale, and then to disappear; the bowels continue constipated, with or without alternations of diarrhœa; the stomach is oppressed after eating; there are various forms of pica or morbid appetite, as for pickles, magnesia, cinders, &c.

With this state of things there is frequently one predominant symptom, which absorbs the attention of the patient and friends, and sometimes even deludes the medical practitioner. This symptom is sometimes a violent recurrent headach; sometimes pain of the side, especially the left side, just under the mamma; sometimes palpitation of the heart; sometimes cough; in other cases these symptoms vary and interchange, and there is frequently every variety of affection comprised in hysteria. This predominant symptom frequently leads to the idea of *arachnitis*, of *pleuritis*, of *disease of the heart*, or of *incipient phthisis*.

Chlorosis is frequently complicated with hæmatemesis and melæna, and with epistaxis. In the latter affection the blood occasionally scarcely tinges the linen on which it drops.

There is also frequently in this disease the peculiar affection designated by Dr. Willan, the erythema nodosum, and of which an account will be given in its proper place.

The second stage gradually passes into the third, in which some degree of emaciation is added, the œdema assumes a more or less aggravated form of anasarca, and a proportionate degree of danger now attends the complaint.

It frequently happens, from the insidious character of this affection, and from the severity of the predominant symptoms, that the case is mistaken for one of an inflammatory character. The affection of the head, the pain of the side, the palpitation of the heart, have severally led, in many instances, to an abstraction of blood, equally inappropriate and useless, if not absolutely injurious and dangerous.

The distinction is not always easy. One of the best sources of the diagnosis, in doubtful cases, is the degree of susceptibility to faint from the detraction of blood. This circumstance, added to the general symptoms and to the inefficiency of those remedies which are adapted to the case of inflammation, is an important criterion of pains which are not inflammatory. (See Bloodletting.) The quantity of blood which has been unwittingly detracted, and the number of leeches and of blisters which have been uselessly as well as needlessly applied in some of these cases, are quite extraordinary.

[Singular phenomena are afforded by chlorosis on auscultating the blood-vessels. One of these has been termed *bruit de diable*, in consequence of its resemblance to that of the *diable* or humming-top of children. It is heard most frequently along the carotid and subclavian, and, at times, in the crural arteries; but never to the same degree. Commonly, it is heard on one side only. M. Raciborski (*New and Complete Manual of Auscultation and Percussion*, translated by H. Fitzherbert, p. 139: Lond. 1835,) affirms, that during a year and a half that he had punctually attended the clinical wards of M. Bouillaud, he had observed the *bruit de diable* more than thirty times, and had not met with a single chlorotic patient that was without it. It would appear, that this sound is connected with a predominance of the watery portion of the blood, but the precise mechanism of its production is not very intelligible.

From an analysis of 88 cases of anæmia, in which there was a continuous or intermittent sound heard over the carotids, M. Andral (*Hématologie Pathologique*, Paris, 1843,) has endeavoured to establish a ratio between a diminution in the amount of globules and such sound. Of the 88 cases, the *souffle* was continuous in 56; intermittent in 32. Of the 56 cases, in which it represented the *bruit de diable*, in 28, the proportion of globules was not above 80, and descended as low as 21. The results of his observations showed, that in different persons the arterial *souffle* does not always appear with the same degree of depression in the proportion of globules. He thinks, that the following rules exist on this subject. *First.* When the ratio of globules has gone below 80, the *bruit de souffle* exists in the arteries continuously. To this law he has not seen an exception. *Secondly.* When the globules remain above 80, the *bruit* may still exhibit itself; but it is no longer constant. It is still heard when the proportion of globules varies between 80 and 100; and occasionally when it is above 100.]

Causes.—The most usual exciting causes of chlorosis are delicate and sedentary habits: the predisposing causes are those peculiarities of the constitution involved in the lymphatic temperament. From the influence of one or both of these causes, chlorosis frequently prevails amongst young persons of the same family; and when the female part of a family suffers in this manner, a slight degree of the same or of a similar affection is frequently traceable in the males, denoted by unwonted pallor of the lips, and an œdematous condition of the tongue.

The influence of such habits in such a temperament as has been described, is first seen in a confined state of the bowels; the colon becomes loaded, and the functions of the other digestive organs, with the processes of assimilation and sanguification, become deranged.

In an early stage of chlorosis the catamenia are observed to become pale and scanty, and eventually they cease. This circumstance has led to the opinion that the peculiar condition of the generative organs, about the age of puberty, had much influence in inducing the state of chlorosis. Dr. Cullen contends that the retention of the catamenia in these cases "is to be referred to a certain state or affection of the ovaria;" but this he does not "pretend to explain." Dr. Hamilton, in his admirable work on Purgative Medicines, has argued against this notion so satisfactorily as to leave little for subsequent writers to do. It is quite obvious, on carefully tracing the succession of symptoms, that the first link in the chain is constipation, and that the subsequent links are the effects of the continued operation of this cause.

In some manufacturing districts, chlorosis and some affections strictly allied to it, may, from the habits of the people, be justly said to be endemic. In manufacturing towns, in Nottingham, for instance, the youthful and almost the infantine parts of the population are engaged during many hours of the day bending over the tambour or lace-frame. The baneful influence of the want of air and exercise, and of a sedentary occupation, are speedily visible in the pallid and icterode states of the complexion, and in the listless manner of these youthful sufferers. The bowels first become confined and loaded; the appetite repels simple food; the breath becomes tainted; the gums become swollen and pale, and the teeth decayed. This state is gradually followed by the other appearances and affections observed in chlorosis.

Servants, and especially cooks, are particularly liable to chlorosis. But the delicate and inert habits of the rich not less frequently lead to this affection.

In all there is the same torpor of the bowels, the same defective digestion, assimilation and formation of blood.

Pathology.—Amongst the series of morbid changes induced in chlorosis, is an impaired condition of the blood itself. This fact is particularly noticed by M. Andral in his Anatomie Pathologique, t. i. p. 87. The quantity of serum is proportionately augmented, that of the crassamentum diminished. This appears to be the true source of the pallor characteristic of this disease, and of the greater or less deficiency in colour and in quantity of the catamenia. This is also most probably the cause of many of the symptoms of chlorosis which resemble, in so many respects, the case of anæmia from actual loss of blood. The same circumstance is also the cause of two events occasionally observed to take place in cases of chlorosis; namely, *delirium* or *mania*, and *sudden death*.

[In addition to the diminution in the proportion of the clot to the serum in the blood of chlorosis, it is deficient, as before remarked, in red corpuscles; hence, probably, the diminished temperature of the surface; the pallor and waxy appearance, as well as the want of colour in the catamenia, and the pale stain which the blood, in cases of chlorotic epistaxis, leaves upon linen. In two well-marked specimens of chlorotic blood, observed by Dr. B. Babington, (Art. *Blood, Morbid Conditions of the*, in *Cyclop. of Anat. and Physiol.*) it contained 871 and 852 parts of water in the 1000, instead of 780, the healthy proportion; and the colouring matter amounted to 48.7 and 52 respectively, instead of 127. The albumen and salts were in the usual proportion. As a general rule it may be inferred from the experiments of Messrs. Andral and Gavarret (*Annales des Sciences Naturelles*, Dec. 1840, & Mars 1841,) the proportion of red corpuscles is diminished, whilst that of the fibrin remains the same; so that the clot, although small, may be firm. Owing to the diminution in the proportion of red globules, whilst the fibrin remains the same, the blood of chlorotic patients is not unfrequently buffy. (See, on all this subject, the writer's *Practice of Medicine*, 2d edit. ii. 632: Philad. 1844.)]

In two cases the writer has witnessed complete mania in chlorosis. One of the patients speedily recovered; and the other was conveyed to a distant hospital, and died from the effort.

Four cases of chlorosis in which death took place suddenly have fallen within the writer's knowledge. In one of these a careful post-mortem examination was made. The patient having been confined to bed for a few days with cold, became much better, and was in good spirits; after having sat up for a quarter of an hour, and talked cheerfully, she suddenly became faint, gasped, and expired. On examination, some effusion was found in the ventricles of the brain, in the pericardium, and the left cavity of the pleura, the right cavity being obliterated by adhesion; the lungs were gorged with serum; the heart was large; the liver much enlarged; the hands were of an ivory whiteness; the ancles were slightly œdematous; and there was abundance of adipose substance. The blood was pale and aqueous, and the clots formed in the large vessels were small and light coloured.

The occurrence of sudden death in some affections termed nervous, and deemed innocuous, is a fact which has not been sufficiently noticed. The writer has been informed of several such cases within the last two years. He suspects that the patients have been chlorotic and bloodless, and that the case is like that of sudden death occurring after great loss of blood.

Treatment.—The remedies for chlorosis are principally mild but efficient aperient medicines and chalybeates. It is important, in the first place, to remove any load from the bowels by an ample dose of medicine, such as an ounce of the oleum ricini. Afterwards, pills consisting of two grains of the Barbadoes aloes and the same quantity of the sulphate of iron, taken daily during dinner, are most efficacious, and indeed, in the writer's experience, almost specific.

It is sometimes useful to interpose a draught of the tinctura and infusum rhei with manna; at other times, senna and the Epsom salt are required to move the bowels sufficiently. In other cases the warm water enema is necessary to ensure the due effect of the aperient medicines.

Other forms of the chalybeates are also occasionally advantageous, and especially the ammoniuret in the form of tincture, and the carbonate.

A mild, light, nutritious diet must be enjoined with these medicines; and a system of moderate exercises, in the free open air, especially riding on horseback, must be enjoined, carefully avoiding fatigue. The general surface, but especially the feet, must be kept warm.

It is often necessary to employ some distinct remedy for the pain of the head or of the side; and a blister is the best. The palpitation also occasionally demands a remedy, and the tinctura hyoscyami relieves this symptom. Leeches, and, *à fortiori*, general bloodletting are highly injurious, perpetuating the constitutional disease.

Chlorosis is frequently produced, and frequently aggravated or protracted by some mental cause. It is important that the physician should at least be aware of this fact; he may then sometimes be enabled to remove an obstacle to the recovery of the patient, which, whilst it existed, might frustrate all his efforts.

The remedies for chlorosis may be enumerated thus: the aloetic chalybeate; mild nutritious diet; exercise and air; horse-exercise and the sea-breezes are also highly useful.

Many other remedies have been proposed for chlorosis; but, in the writer's opinion, they are both inefficient and unnecessary. Those which have been enumerated have seldom failed to remove the disease; whilst the other forms of aperients and chalybeates have appeared far less efficacious. The well-known Griffith's mixture, the mistura ferri composita, and the precipitated carbonate of iron, are of this character.

[At the present day, the subcarbonate of iron is employed perhaps more than any other. The protocarbonate is also used in the form of the Pilulæ Ferri Carbonatis of the Pharmacopœia of the United States, of 1842. They are the pills of Vallet, so called after their proposer; but they have not appeared to the writer to possess any advantage over the subcarbonate. The citrate and the iodide of iron have likewise been used of late with benefit in this affection, (*New Remedies*, 4th edit. p. 274 and p. 290.) If the blood be examined after iron has been given for some time, the proportion of the red corpuscles will be found to have augmented.]

A disease similar to chlorosis, which yields to similar remedies, occurs in infants and children, and might for the sake of distinction be termed *leucosis*, from λευκὸς, *white*. The lips and cheeks are of a waxen pallor; the tongue, the hands, and the general surface are perfectly exanguious; and there is extreme feebleness. A few grains of rhubarb with one-fourth of a grain of the sulphate of iron, given twice a day, with a light nutrient diet, and the fresh air, and attention to warmth, speedily restore the little patient to its wonted strength and colour. This affection has been little noticed. If neglected, it sometimes takes the patient off with symptoms resembling those of hydrencephalus.

A disease similar to chlorosis also occurs in married females. This affection sometimes, but not always, arises from actual loss of blood; the late Dr. Gooch has designated such a case *acute chlorosis.* More frequently an exanguious condition of the system arises from a defective assimilation and formation of blood. The aloetic chalybeate is the remedy of greatest efficacy in restoring the hæmatosis.

The occurrence of chlorosis in the delicate of the male sex has been noticed by Dr. Hamilton, Sir Gilbert Blane, and others, and will become familiar to all who study this affection with attention. It has been already stated that in families in which chlorosis prevails amongst the females, a similar affection seems to attack the males. In some such instances the writer has seen chlorosis in its most marked character in the male sex. It is removed by the aloetic chalybeate.

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CHOLERA.—This word is generally supposed to be derived from χολὴ, *bilis*, and the authority of Celsus is ordinarily quoted in support of this etymology. There is, however, an obscurity in the passage usually referred to in the works of this writer, which renders it doubtful whether he means that bile or the forcible manner in which it is ejected has given origin to the name of the disease; for the Greek word χόλερα signifies a water-spout as well as the disorder of which we are treating, and it has been suggested that the adjunct *morbus*, so frequently annexed to it, when employed in the latter sense, was thereby rendered necessary for the purpose of due discrimination. However this may be, it is manifest from passages of different writers, especially from one of Celsus himself, that the words χολὴ and *bilis* had a much more extended sense than our word bile, being by no means restricted to the secretion of the liver, but applied to any liquid discharge from the intestines. By Trallian the word is derived from χολάδες, *intestina.*

The disease being one of frequent occurrence at certain seasons in various climates, and its symptoms being of a very manifest nature, it early attracted the attention of medical writers. It is mentioned at some length by Hippocrates (Epidem. lib. v.), who divides it into the moist and dry species, an arrangement which has been adopted by some much more recent authors. Celsus has a chapter upon it (cap. xi. lib. iv.) in which its symptoms are detailed with his accustomed accuracy, brevity, and elegance; and notice is taken of the occasional occurrence of a watery and a white discharge, circumstances which recent events have invested with considerable importance. He regards it as a highly dangerous disease, and speaks of the deaths produced by it as of sudden occurrence. Aretæus treats of the disease, and is rather minute in his description of the discharges. The matter vomited is at first, he informs us, like water, and the alvine dejections are liquid and stercoraceous; whilst, if long indigestion has been the exciting cause of the disease, the discharges are at first *pituitous*, then bilious. Of more modern writers, our own Sydenham treats of the disease with that accuracy of observation and practical good sense which are his chief characteristics as a writer. He regards cholera as having in this country an epidemic prevalence only during the months of August and the early part of September, and declares that any occasional case which may occur at another season, however similar to the epidemic in character, is in its nature essentially distinct from it. Morton (Pyretologia, p. 16, &c.) and Torti (lib. iii. cap. i. p. 124,) have described cholera as appearing in an intermitting form and curable by bark.

The disease is placed in the class *fluxus* and order *alvifluxus* of Sauvages; in the class *neuroses* and order *spasmi* of Cullen, and very appropriately in the class *cœliaca* and order *enterica* of Dr. Good.

The following definition will probably comprise every case really belonging to the genus cholera:—vomiting, purging, spasms, prostration and collapse, or any four of these symptoms occurring simultaneously or in a succession more or less rapid.*

For practical purposes it seems sufficient to consider cholera as divided into two species, ordinary cholera and the epidemic or malignant disease; such deviations from the common type of these disorders as are occasionally met with being indicated in the course of the article; [after which, some remarks will be made on cholera infantum.]

I.—Common, or Sporadic Cholera.—Ordinary cholera may be thus defined:—vomiting and purging, the discharges during great part of the course of the disease containing generally a large proportion of bile; pain in the stomach and intestines; spasms, especially of the muscles of the abdomen and lower extremities, and prostration. If collapse occur, it takes place after the disease has endured some time apparently, as an effect of the great discharge, spasm, and irritation.

Besides these distinctive marks of the disorder, there is generally found great inflation of the stomach and bowels; the fluid vomited is frequently enormous in quantity, consisting at first of the food in the stomach, and subsequently of matters variously coloured from light brown to dark green, and expelled with great force; and the stools, the appearance of which indicates during the greater part of the course of the disease, the same redundancy of biliary secretion as is denoted by the matters vomited, are generally copiously and forcibly expelled, though sometimes sparingly and with difficulty. The dark appearance here attributed to the discharges in ordinary cholera must be considered as generally applicable only to this disease as it occurs in our own and other temperate climates; for a white appearance of such matters had been remarked as an occasional circumstance, by Celsus and various other physicians, in the warmer regions long before the occurrence of the epidemic which has recently attracted so much attention. At the commencement of the attack the skin is generally warm and dry; but after a few hours its temperature falls considerably below the standard of health, and it is bedewed with a cold and clammy moisture. The tongue is dry and the thirst excessive; the urine scanty and high-coloured; the pulse rapid, and generally small and irregular; and the spasms which affect the muscles of the abdomen and of the inferior extremities, and occasionally those of the hands and arms, recur at short intervals, and are attended with great pain. After the disease has continued some time, the countenance appears anxious, ghastly, and shrunk; the voice is feeble and interrupted; the sense of exhaustion is extreme, and in severe and protracted cases the tendency to fainting is great and alarming.

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* This definition is modified from that of Dr. Macann.

Ordinary cholera in temperate climates is not very often fatal; yet it is a dangerous disease, and one which requires much attention on the part of the practitioner. The approach of death is denoted by the continuance of the vomiting and purging, especially of the latter; by hurried breathing; a countenance either of a purple hue, or pale, anxious, and contracted; a feeble and fluttering pulse, and coldness of the extremities and surface generally. Cessation of the vomiting and purging; warmth of the skin; the pulse approaching the surface with a diminution of its frequency; the restoration of a tranquil expression to the countenance, and the recruiting of the powers of the patient from a state of oppression and exhaustion, indicate recovery.

It not unfrequently happens that for some days after the subsidence of vomiting, purging, spasms, and other violent symptoms mentioned, the patient feels some uneasiness in the epigastrium and other parts of the abdomen, which is increased on pressure. The pulse is at the same time sharp and frequent; the tongue always dry, and either red and glazed, or covered with a brown fur; there is great thirst with complete inappetency, and occasionally nausea, and the bowels are generally costive, though they may be readily excited to action by laxative medicine if the stomach can be made to retain it, the discharges procured being usually of a dark green appearance. These symptoms, which denote gastro-enteritis supervening on the high degree of irritation of the lining of the digestive canal, require diligent attention; for some cases in which they had been overlooked have proved fatal, though the patients had previously emerged from a state apparently more urgent and dangerous.

Diagnosis.—The factitious disorder produced by an irritating poison, and the epidemic species of the disease, are the only affections of the system with which there is any risk of our confounding the form of cholera at present under discussion. The distinction from the latter affection we shall endeavour to point out in a subsequent part of the article. Professor Christison (Treatise on Poisons, p. 93, et seq.) places some reliance on the respective duration of cases of fatal cholera and of poisoning from the irritants, as a ground of distinction between them. He informs us that death from irritant poisons is seldom delayed beyond two days and a half, and frequently happens within thirty-six hours, sometimes within twelve hours, or even less; whilst death from cholera at any time is rare, but within three days very rare indeed, though it may occur in twelve hours. This statement itself shows that the comparative duration of these affections furnishes no secure means of distinguishing them; and our experience tells us, besides, that death from cholera within three days, or even in twelve hours, is much less rare than this able writer supposes. Another discriminating test pointed out in the Treatise on Poisons, the sanguinolent vomiting which attends cases of poisoning, we fear is not more tenable than the preceding; for though a rare, we know from observation that it is not an unexampled accompaniment of cholera.

Though these circumstances, the duration of the disease when fatal, and the presence or absence of sanguinolent vomiting, seem insufficient to distinguish the two affections, yet the conclusion to be arrived at is, that the diagnosis between cholera and poisoning may in many cases be formed from symptoms alone; and certainly, that no observing practitioner would be long at the bedside of a patient who had swallowed an irritating poison in a dose likely to prove fatal, without discovering that he had something different from natural disease to contend with. It is true that he might not have evidence of the fact sufficient to establish it in a court of justice, but his conviction would be such as to excite him to an examination calculated to elicit satisfactory legal testimony. The sense of burning in the throat, extending thence down the œsophagus to the stomach, is dwelt upon by the sufferer in a way that is never observed in cases of cholera, in which the patient complains of intense pain, but never dwells upon this burning feeling as constituting the chief source of his sufferings, though he may acknowledge its existence if questioned. Besides, as Professor Christison justly observes, it is certain that the sense of acridity or burning sometimes remarked in cholera never begins before the vomiting, whereas in many cases *of poisoning*, though certainly not in all, it is the first symptom. It may be remarked, too, that it is often stated by the sufferer to have occurred either immediately or shortly after the swallowing of something.

Nature of the Disease.—The first effect of the application of the cause of cholera seems to be a violent irritation of the mucous lining of the stomach and small intestines, which is propagated to the liver either by continuity along its ducts, or by sympathy between organs whose actions are so intimately associated. Some writers, reversing the order here stated, consider the liver as the part first affected, and the manifest disorder of the digestive canal to be the effect of the derangement of that organ. The order first mentioned seems more in accordance with the agency of the usually assigned causes of the disease, with its phenomena, the effects of remedies upon it, and the appearances on dissection. The irritation is extended, it would appear, not merely to the liver, but likewise to the spinal marrow; at least the parts supplied with spinal nerves are the seat of violent spasms. The state of the heart's action at the onset of the disease, before exhaustion can be supposed to have resulted from the mere effect of the discharges, renders it probable that it is affected through the medium of the gangliouic nerves or spinal marrow. Whatever view may be taken of the structures primarily affected in cholera, it seems beyond all question that those we have enumerated are the parts principally concerned in producing its symptoms.

Appearances on Dissection. — When the disease is rapidly fatal, there is no discernible lesion of structure; but if death occur after the lapse of some days, and especially if it take place from the gastro-enteritis which has been described as supervening on cholera, the mucous lining of the stomach and small intestines is found more or less strongly injected.

Causes.—This disease was supposed by Sydenham to be peculiar to the month of August, and it certainly in this country occurs more frequently during this month than any other; but it may be observed at any season of the year when a warm atmosphere during the day alternates with a considerable degree of cold at night. As might be supposed from this statement, its most frequent exciting cause is exposure to the chill of damp or cold air after unusual heat. On the same principle, drinking cold water when the body is heated has occasionally produced an attack. Cases occur, too, in consequence of taking food or liquid calculated to irritate the stomach and bowels. Malaria has been supposed to be a cause of the disease; and this opinion derives a great degree of probability from its appearing at the season when autumnal intermittents and remittents prevail, and the fact that many cases of sub-continued or slightly remitting fever, and even of ague, have been observed, which commenced with symptoms identically similar to those of cholera, (Medical Essays, by *J. Brown*, M. D., p. 38). A remarkable example of the malarious origin of the disease occurred at a school at Clapham, in August, 1829. A very foul drain, or cesspool, was opened, and its contents were thrown into a garden adjoining the school. A day or two afterwards one of the boys was attacked, and in two days more twenty others out of the total of thirty. The disease appears to have considerably resembled the Indian epidemic, the evacuations being much less tinged with bile than is usual in the ordinary cholera of temperate climates. Two cases terminated fatally. It was held by the highly respectable medical authorities assembled on the occasion, that the effluvia from the putrid matter had produced the disease, (*Searle* on Cholera, and *Orton*, p. 415).

Treatment.—The counsel ordinarily given is to defer the employment of medicine for some hours after the commencement of the disease, limiting our endeavours during this period to the administering diluents, such as gruel, thin chicken-broth, beef-tea, barley-water, &c.; but even if the patient's earnest appeals for relief would allow of this delay, it seems more than questionable whether it would be justifiable; for some time has generally elapsed before medical aid is obtained, and the cases must be rare indeed in which more powerful agents than those mentioned may not be employed at the time of our arrival, and are not, in fact, demanded.

Opium is the remedy which, from its well-known effects in other diseases, would naturally present itself to the mind of the physician as likely to allay the irritation; and it is in reality the best which he can employ. In mild cases, it is often found to be the only medicine required; but in more severe attacks it may be advantageously conjoined with calomel, the combination of these medicines having an excellent effect in allaying gastric and intestinal irritation. In slight cases, a grain of opium, or a proportionate quantity of laudanum, may be given every second hour till relief be obtained. In those which are more severe, two or three grains of calomel, combined with a grain of opium, may be given at the same interval till three or four doses shall have been taken; or, the calomel being administered in pill, a draught containing a proportion of laudanum or black-drop, equivalent to a grain of opium, may be exhibited along with it.

Subsidiary measures should accompany the employment of these medicines. The diluent drinks already mentioned should be given at intervals to allay the urgent thirst of the patient, but in small quantities, lest they excite vomiting. Hot fomentations to the abdomen are well calculated to afford relief; and the patient, if not much exhausted, may remain for a quarter of an hour in a bath of 100°, if it can be obtained. It must be observed, however, with regard to the warm bath, that in the epidemic disease the most experienced practitioners decline its employment where there is much collapse, on account of the distress it occasions, and, indeed, from the positive mischief arising from the necessity of removing the sick from the horizontal position: *dry heat* is now generally preferred in those cases, and it will be proper to keep this fact in view in our treatment of the ordinary species, when the exhaustion is considerable. A large blister to the epigastrium, previously fomented with hot vinegar, is frequently useful in relieving the vomiting and internal irritation; or sinapisms are sometimes advantageously employed to produce the same effect more rapidly. Scalding the epigastrium, or, as it is called, the warm-water blister, is the prompt mode occasionally employed in the cholera of the east; but there is reason to apprehend that it would prove abhorrent to the feelings of patients in this country, and would be deemed a needlessly severe treatment of ordinary cholera.

Should there be considerable exhaustion, indicated by coldness of the skin and feebleness of the pulse, diffusible stimulants, such as brandy, ether, and ammonia, should be given in small quantities. Draughts composed of carbonate of magnesia, aromatic spirit of ammonia, compound tincture of cardamoms, and laudanum, are frequently well retained by the stomach, and have a good effect in such a state. Strong beef-tea may be given, if the stomach become tranquil, in small quantities at short intervals, alternately with brandy and water.

General bleeding is neither required nor perhaps admissible, in the course of the symptoms of what may be strictly termed cholera in a temperate climate; but even during such symptoms either there is occasionally such permanent tenderness of the epigastrium, perceived in the intervals of severe pain, vomiting, and spasm, as induces us to conclude that the irritation of the digestive canal has passed into inflammation; or the glazed or furred state of the tongue, the intensity of the thirst, the sharpness of the pulse, and general uneasiness of the patient, without the existence of permanent pain, may lead us to the same conclusion. In either case the application of a dozen or eighteen leeches to the epigastrium will be attended with much benefit. After the leeching, a large emollient poultice may be applied, followed, on the total subsiding of the oozing from the leech-bites, by the application of a blister to the epigastrium.

In the gastro-enteritis, described as sometimes occurring after the cessation of the actual symptoms of cholera, general bleeding may be performed to the extent the patient's strength will admit, not only with safety, but with great benefit. Leeches and blisters to the abdomen, and mild mercurials, particularly hydrargyrus cum cretâ in doses of three or four grains every fourth hour, till some affection of the mouth is perceived, will be found the best subsidiary remedies.

Cholera frequently leaves the patient in a state of extreme debility, which should be sedulously watched, for persons have occasionally died suddenly, when supposed to be recovering from the disease, apparently from exhaustion. The horizontal posture, and mild and nutritious diet, consisting of sago with milk, beef-tea, or chicken-broth, with bread or biscuit, animal-jelly, &c. are the appropriate remedies. If the bowels are costive, they should be moved by enemata; for all the symptoms of cholera have been reproduced, three days after their subsidence, by so gentle an irritant to the digestive canal as a dose of rhubarb.

We had proposed to ourselves to terminate here all that it appeared to us necessary to say under the present head; but we are bound towards the profession to admit that the details which had been laid before us, previously to the manifest appearance of the epidemic disease in this country, through the channels of medical journals, of sporadic cases which occurred in various parts of England during the autumn of last year (1831), preclude the possibility of our hesitating to acknowledge a perfect identity between the group of symptoms in some of those cases, and the symptoms of the choleric stage of the malignant epidemic form in which cholera has of late years committed such ravages. The fullest details are given in several instances, and by persons of whose accuracy we cannot have the remotest doubt. Respecting a case in the seventh regiment at Hull, which proved fatal on the 11th of August, after an illness of sixteen hours and a half, and in which the assemblage of symptoms held to be characteristic of Indian cholera were so very strongly marked, we may state that the gentleman who forwarded the details to the journal in which they appeared has sent us his name, and pledges himself for their fidelity. In this case there were the *blue skin, the total absence* of pulsation in the extremities for some time before death, *the sodden appearance of the fingers, the coldness of the tongue, the change in the voice, and the suppression of urine,* all which are so particularly dwelt upon by innumerable authorities as peculiarly marking the cholera spasmodica.

II.—Epidemic, or Malignant Cholera.—Long prior to the appearance of the present epidemic in the Delta of the Ganges in 1817, and its subsequent diffusion over so large a portion of the globe, extensive and destructive visitations of cholera had been noticed by various writers. One of these, we learn, occurred in Europe at the close of the seventeenth century; but most of them originated in the east, and limited their devastations to that quarter of the world. The indefatigable Mr. Scott has quoted, from the Madras Courier of 1819, a letter, which suggests the opinion that a description, though certainly a very obscure one, of a disease resembling that which now prevails, is to be found in a Hindoo work of great antiquity; and cites instances of the epidemic prevalence and great fatality of cholera from the time of Bontius, in 1629, to the present century; but the description of these epidemic visitations has not always reached us in so detailed a form as to enable us to judge correctly of their identity with what has been recently observed: enough, however, may be gleaned to prevent our denying this identity in some instances; indeed, it is impossible not to be struck with the resemblance which certain of the more accurately reported of these examples—especially one which occurred at Ganjam, in 1781—bear to that now existing. But this much seems certain, that, however cases in previous visitations may have resembled in character those of the prevailing disease, no recorded epidemic of cholera has equalled this in the wideness of its diffusion and the amount of its ravages, or has preserved its character and intensity so little influenced by climate and temperature.

The question of the identity of the disease which now prevails in Great Britain and on the continent of Europe, and that which ravaged Hindostan, having been settled in the affirmative, at least as regards certain of their most important practical points, by the various respectable physicians who have witnessed both diseases, we may assume that much of the valuable information transmitted to us from India, respecting the nature and treatment of the malady which raged there, is applicable to that which is now committing its ravages in Europe.

1. **Symptoms of Cholera in India.**—The disease generally makes its attack in the night, or towards morning, with vomiting so excessive, that the whole contents of the stomach appear to be discharged; and nearly at the same time the bowels are copiously emptied, as though all the solid matters in the intestinal canal were evacuated. In some cases a watery purging precedes the vomiting by some hours; but they more frequently occur simultaneously. After the first copious discharge, the patient experiences a distressing feeling of exhaustion and faintness, with ringing in the ears and giddiness. The subsequent discharges from the stomach and those from the bowels do not differ from each other in appearance, excepting as the matters ejected from the stomach may be tinged by medicines or other ingesta: they are generally watery, colourless, and inodorous, and are compared in their appearance to barley-broth, or more frequently to rice-water. Sometimes they are like milk, occasionally yellowish, greenish, like muddy water or yeast; but the "conjee-stools," as they are emphatically termed, which consist of albuminous flakes floating in serum, or discharges of pure serum, are of the most frequent occurrence. The dejections sometimes take place without effort or uneasiness, but occasionally very forcibly, with simultaneous vomiting, spasm, and sinking of the pulse. This

violent action of the alimentary canal is not of long continuance, the powers of the system being unable to support it: hence the vomiting and purging generally cease some hours before death; but in some cases a discharge of serum takes place from the rectum on any movement of the body till the fatal close.

In most cases, some time after the commencement of this affection of the intestinal tube, but in others previously to it, spasmodic contractions of the muscles of the fingers and toes are felt, and these affections gradually extend along the limbs to the trunk. The spasms are imperfectly clonic or convulsive, with infrequent relaxations, are attended with great pain, and leave for some days afterwards a degree of stiffness in the affected muscles. The pulse is from the first small, weak, and accelerated; and after a certain interval, but especially on the accession of spasms, or severe vomiting, it sinks suddenly, so as to be speedily lost in the external parts. The length of time during which a patient will live in this pulseless state is remarkable. In a case related by Dr. Kellett, the pulse was gone within three hours from the attack, yet the man lived twenty-two hours in that state. On the cessation of spasm and vomiting, and sometimes apparently from the exhibition of remedies, the pulse will return in the extremities for a short time, and again cease. The skin *is cold* from the commencement of the disease, and as it advances, becomes gradually colder, and is covered either with a profuse sweat or a clammy moisture. The state of its circulation and its insensibility are sometimes strongly denoted by the following circumstances: leeches will not draw blood from it; blisters and other vesicatories will not act; and even the mineral acids and boiling water produce no effect, and some patients are not even sensible of their application. In Europeans the colour of the surface is often livid; the lips and nails present a blue tint; and the skin of the feet and hands becomes corrugated, and exhibits a sodden appearance, as if from long immersion in hot water.

With these symptoms coexist violent pain of the intestines, with a sensation of writhing and twisting there; heartburn, which the sufferer compares to a fire consuming his entrails; excessive thirst; anxiety, with inexpressible uneasiness about the præcordia; hiccup; jactitation; and, notwithstanding the actual coldness of the surface, and even of internal parts which are accessible to the touch, the tongue for instance, a *sense* of heat which impels the patient incessantly to throw off the bed-clothes. The breathing is much affected, being performed either more slowly than usual, sometimes for instance, in the advanced stage, only at the rate of seven respirations in a minute, or the inspirations are short and sudden, with violent pain from spasm of the diaphragm; the voice being feeble, hollow, hoarse, and interrupted. The eyes are sunk in their orbits; the corneæ flaccid, the conjunctivæ frequently suffused with blood; the features of the face collapsed; and the whole countenance wears a cadaverous aspect. The secretions, those of the skin and intestines excepted, are generally suspended. The functions of the mind are undisturbed almost to the very last moment of existence.

The approach of recovery is denoted by the rising of the pulse, the return of heat to the surface, inclination to natural sleep, diminution or cessation of vomiting, purging, and spasms, and, after an interval, the re-appearance of bilious stools, urine, and saliva.*

Regarding the above as a picture of the general type of a disease rather variable in character, we shall proceed to relate the more striking deviations from the ordinary form which were observed in India.

Instead of the exceedingly sunk state, there was a marked excitement, with a hot and dry skin, and a pulse of considerable force, in several instances throughout great part of the course of the disease. (Madras Reports, p. xxv.) This in some cases arose from the early exhibition of stimulants, but in others it appeared to be an essential part of the disorder. These cases yielded most certainly and readily to treatment; and hence, many of them having been subdued without the occurrence of sinking or debility, it was a matter of doubt whether this description of disorder really belonged to the epidemic; but that it did so was placed beyond all question by some of the more protracted cases degenerating into the ordinary low form.

The most fatal variety of the disease was denoted by the slightness of the commotion in the system: there was no vomiting; hardly any purging, perhaps there were only one or two stools; with no perceptible spasm; no pain of any kind; a mortal coldness with arrest of the circulation coming on from the beginning, and the patient dying without a struggle within three or four hours. Several instances were heard of, at Hoobly and other places, of natives being struck with the disease, whilst walking in the open air, and who, having fallen down, retched a little, complained of vertigo, deafness, and blindness, and expired in a few minutes. Mr. Scott informs us that this most deadly form of the disease frequently manifested itself in local epidemic visitations, which were often observed in India, all the cases occurring at the same time in a given district partaking of the same peculiarity of character.

The collapsed form of disease first described is that which has been most frequently observed. In fatal cases its duration varies from four to eight hours; whilst in those which terminate favourably, a result often apparently due to early medical assistance, the patient may be restored to perfect convalescence in a period ranging from twenty-four to forty-eight hours. But in many cases considerable disturbance of the system intervenes between the period of collapse and restoration to health, or this disturbance may itself cause death. The Indian reporters mention two forms of this disorder. In the one, with some excitement in the system, the bowels continue to discharge, for many days, first brown and watery, then dark, black, and pitchy stools, sometimes with blood, and with peculiar pains in the bowels, particularly in the rectum. The other a distinct febrile form, we shall describe in the language of the Bengal Report:—

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* *Scott's* Reports on the Epidemic Cholera; *Anderson* on Cholera, E. M. and S. Journal, vol. xv. p. 324; *Christie* on Cholera and the Pathology of Mucous Membranes; *Annesley's* Sketch of the Diseases of India, &c.

"The fever which almost invariably attended this second stage of the disease (in Europeans), partook much of the nature of the common bilious attacks of these latitudes. There was a hot dry skin, a foul deeply-furred tongue, parched mouth, thirst, sick stomach, restlessness, watchfulness, and quick variable pulse, sometimes with delirium and stupor, and other marked affections of the brain. Generally, when the disorder proved fatal in this stage, the tongue, from being cream-coloured, became brown, and sometimes black, hard, and more deeply furred; the teeth and lips were covered with sordes; the state of the skin varied, chills alternating with heats; the pulse became extremely quick, weak, and tremulous; hiccough, catching of the breath, great restlessness, and deep moaning succeeded; and the patient soon sunk, incoherent and insensible, under the debilitating effects of low nervous fever, and frequent, dark, tarry, alvine discharges."

A consecutive fever, similar to this, we learn from Drs. Russell and Barry, is of more frequent occurrence in Russia than in India. The following description of it we owe to these gentlemen:—

"After the blue cold period has lasted from twelve to twenty-four, seldom to forty-eight hours or upwards, the pulse and external heat begin gradually to return, headach is complained of, with noise in the ears, the tongue becomes more loaded, redder at the tip and edges, and also drier. High-coloured urine is passed with pain and in small quantities, the pupil is often dilated, soreness is felt on pressure over the liver, stomach and belly; bleeding by the lancet or leeches is required. Ice to the head gives great relief. In short, the patient is now labouring under a continued fever, not to be distinguished from ordinary fever. A profuse critical perspiration may come on from the second or third day, and leave the sufferer convalescent; but much more frequently the quickness of pulse and heat of skin continue, the tongue becomes brown and parched, the eyes are suffused and drowsy; there is a dull flush with stupor and heaviness about the countenance much resembling typhus, dark sordes collect about the lips and teeth, sometimes the patient is pale, squalid, and low, with the pulse and heat below natural, but, with the typhous stupor, delirium supervenes, and death takes place from the fourth to the eighth day, or even later, in the very individual, too, whom the most assiduous attention had barely saved in the first or cold stage. To give a notion of the importance and danger of cholera fever, a most intelligent physician, Dr. Reimer, of the Merchant-Hospital, informs us, that of twenty cases treated under his own eye, who fell victims to the disease, seven died in the cold stage, and thirteen in the consecutive fever."*

The same gentlemen state, as the result of their observation, that the following are the points of difference between the European epidemic and that of India:—

"First, the evacuations, both upwards and downwards, seem to have been much more profuse and ungovernable in the Indian than in the present cholera, though the characters of the evacuations are precisely the same.

"Secondly, restoration to health from the cold stage, without passing through consecutive fever of any kind, was by far more frequent in India than here (St. Petersburgh), nor did the consecutive fever there assume a typhoid type.†

"Thirdly, the proportion of deaths in the cold stage, compared with those in the hot, was far greater in India, according to Dr. Russell's experience, than here.

"Fourthly, the number of medical men and hospital attendants attacked with cholera during the present epidemic, in proportion to the whole employed, and to other classes of society, has been beyond all comparison greater here than in India under similar circumstances."

Dr. Kier of Moscow, gives the following description of the consecutive or secondary morbid state. "A second ordeal now begins, sometimes as severe, and frequently not less fatal, though more slowly so, than the first; this is probably the effect of the morbid changes which have been induced during the first period of the disease. The appearance of the complaint is now entirely changed, insomuch that one who had not seen the patient during the first period, or been told of the symptoms, could not possibly know that he was suffering from the epidemic. I have observed the disease in this, its second period, to assume four forms: the first, an inflammatory, or rather sub-inflammatory state of the stomach and bowels, most frequently the latter, sometimes conjoined: the second, inflammatory irritation of the lungs, with pain of the chest, cough, viscid expectoration, and fever, appearing as a critical metastasis of the disease: the third, bilious or bilio-nervous fever, with suppuration of the parotid glands; in one case, with axillary suppurating bubo, towards the end of the fever, an inflammatory irritation of the lungs took place, ending in vomica: and the fourth, a congestive sub-inflammatory state of the brain and spinal chord. This last, as was natural to expect from the nature and seat of the affection, proved by far the most dangerous and most frequently fatal form of the second period: it appeared generally to supervene after the purging, vomiting, and cramps had been relieved, and the external heat in some degree restored; the patient complained of pain in the back, between the shoulder-blades, or in some other part of the spine, sometimes along its whole tract; he appeared sleepy to such a degree that at first I was disposed to attribute this state, in part at least, to the effects of the opium given in the first period. But I was soon convinced that the cause of this symptom, and of another strongly characteristic of this form of the disease, namely, the filling of the vessels of the sclerotica with red blood, was a congestive sub-inflammatory state of the brain and spinal chord. This striking symptom at first began to show itself in the inferior part of the globe of the eyes; it gradually increased, and little by little reached the upper part, while the eyes turned upwards, exposing the lower part gorged with blood. The state of the patient generally ended in a complete coma, and proved fatal a few hours afterwards."

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* Report of Drs. *Russell* and *Barry* to C. C. Greville, Esq., published among other papers, by authority of His Majesty's Most Honourable Privy Council.

† If we compare the symptoms attributed to this consecutive fever by Drs. Russell and Barry, with those quoted from the Bengal Reports, the difference between this stage of the respective epidemics does not appear very striking: the epithet *typhoid* seems almost equally applicable to both. Varieties were observed in the disease as it prevailed in the different Indian presidencies, and likewise between that which existed in Hindustan and Ceylon, perhaps as considerable as those now observed by these intelligent physicians. In regard to what is stated in the extract referred to, relative to the greater frequency at Petersburgh of the secondary "typhoid," or, as more commonly designated in India, low biliary symptoms, we confess that we observe a discrepancy when we read a subsequent part of the same Report, in which Drs. Russell and Barry state, "Convalescence from cholera has been rapid and perfect here, as is proved by the following fact. The Ministers of the Interior had given orders that all convalescents, civil as well as military, at the General Hospital, should be detained fourteen days. We inspected about two hundred of these *détenus* some days back, with Sir J. Wylie, and found them in excellent health, without a single morbid sequela."

Besides the various and appalling symptoms which indicate general derangement of the action of the solids, there are appearances in the blood drawn during the collapsed stage, showing that the fluids feel the influence of this formidable disease. These appearances are very uniformly expressed by the terms dark, black, or tarry, in regard to colour, and by thick, ropy, syrupy or semi-coagulated, in respect to consistence. This change in the condition of the circulating fluid is *fully* proved to be in the ratio of the duration of the disease; the blood at the commencement seeming to be nearly or altogether natural, and more or less rapidly assuming a morbid state as the malady advances. This condition was less conspicuous in cases of cholera ushered in by symptoms of excitement, than where the collapsed state of the system had occurred early; and in certain rare cases it was not observable at all, and the blood flowed readily from the vein; but the reverse was the fact, both with respect to its condition and the manner of its flowing from the arm, in an immense majority of instances. In general, after a certain quantity of dark, thick blood had been drawn, its colour became lighter, its consistence less thick, and the circulation revived, such appearances always affording grounds for a proportionably favourable prognosis. There is some discrepancy in the accounts transmitted to us of the mode in which this diseased blood coagulates. In some instances, we learn, the coagulation is rapid, whilst in others it is slow and imperfect. Reporters are unanimous in declaring it deficient in serum, and destitute of the buffy coat. The latter is occasionally observed in cases attended with re-action, in which the blood is not black and thick. (Madras Report, p. xxx. &c.)

The discharges from patients suffering under this disease were subjected to experiment by Dr. Christie. The secretion consists of two substances, the one a transparent serous fluid, the other an opaque coagulum; the former perfectly soluble in cold water, the latter quite insoluble. These matters being submitted to the action of re-agents, the fluid part was found to be pure serum, and the coagulated portion fibrin. The secretion, therefore, as the author remarks, has a composition similar to that of the blood deprived of its colouring matter; but the serum is in much larger proportion to the fibrin than in that fluid.

Chemistry has been occupied in researches into the composition of the blood and of the secretions in this disease since it has extended into Europe. Mr. Herman, of St. Petersburgh, who regards free acetic acid as an essential constituent of the blood when in a healthy state, finds a deficiency of it in that of choleric patients. This gentleman, like our Indian practitioners, has observed that the crassamentum bears a larger proportion to the serum in this disease than in health; and this increased relative quantity of crassamentum was found to be in direct proportion to the intensity of the disease. The fluids voided by stool and vomiting contained, he informs us, besides water, some acetic acid, a small quantity of osmazome, salivary matter, butyric acid and mucus. They very much resemble gastric juice, but do not contain any free muriatic acid. In the alvine discharges, the quantity of butyric acid is greater than in the fluid voided by vomiting; and they contain, besides, some albumen, a fetid, oily matter, and a small admixture of bile.*

2. **Character of the epidemic as it appeared in Sunderland in 1831.** — Thus far our account of this formidable malady has been derived from the very valuable mass of information with which we have been favoured by our medical brethren in India, and the many intelligent men who have witnessed its ravages on the continent of Europe. Circumstances having brought it under our own observation, we shall endeavour to convey succinctly to the reader the results of our experience, prefaced by a few reflections on the character and designation of the disease, which this experience has suggested to us.

A question has been repeatedly discussed, but without having been so far settled as either to lead the profession to feel satisfied with the name first given to the disease, or to adopt a designation more consonant with its nature, viz.— can it properly be considered as belonging to the genus cholera? or is its character so much more closely related to that of fever as to render it advisable, consistently with accuracy of arrangement and precision of nomenclature, to place it among febrile disorders, and give it a designation more corresponding than its present one with its new nosological position. The vomiting, purging, spasms, and prostration which are generally considered as the pathognomic symptoms of cholera, belong equally to a certain stage of this disease as to the ordinary form; and, in addition to this argument, it may be urged that only a strong affinity could have led men so intelligent as our Indian practitioners unanimously to designate it by the term cholera. It is true, that if we limit our view to one stage only of the disease, the former reason is forcible; but if we embrace, as we ought to do, all its parts as we witness them in Europe, — if we consider that the choleric symptoms, if not fatal, prove but the commence-

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* Letter to Dr. Todd, (Medico-Chirurgical Review, July, 1831, p. 285.)

A specimen of the intestinal discharge from a child three years old, labouring under the disease, with which we furnished M. Magendie when he visited Sunderland, was analysed by that gentleman; and he informed us that it contained albumen and mucus, and was *alkaline* ment of a series of changes to which any one who witnessed them alone would give the appellation of fever, and which men of great experience in the disease have declared they could not distinguish from typhus—if we observe, too, that long before this epidemic excited attention, symptoms strikingly resembling those of cholera had been observed to form the initiatory stage of certain malignant fevers,* —we are disposed to admit that it is in reality a fever, and that to designate it merely cholera is to take a part for the whole, and to give to the inexperienced, as far as a name can give it, an erroneous idea of the disease. At the same time it would be advisable to mark its relation, a relation which it unquestionably possesses, to the disease from which it is dissociated, and to apply to it the trivial epithet *choleric*. Consequently with these views, we should advise that the name suggested by Dr. Johnson, *epidemic choleric fever*, be in future adopted as its designation.

The argument against this change derived from the universal employment of the other name by our Indian practitioners, is not of much force; for it is manifest, from many circumstances, that in Hindostan, the disease, in the majority of instances, consisted of the cold stage only, many reporters not at all adverting to the consecutive fever; and Mr. Jameson alone, in the Bengal Reports, treats of it at any considerable length. So rare indeed was it, that we have met with Indian physicians of no inconsiderable experience in the disease, whose observation it had escaped altogether. It should be remarked, too, that Mr. Jameson declares the febrile stage to have been rare and slight among natives in general; but that it frequently occurred in Europeans and natives of robust and athletic make. It would appear, that, in proportion as the disease has receded from its original source, it has been undergoing more and more a transmutation into a febrile character. Drs. Russell and Barry, it will have been remarked, state that restoration to health from the cold stage, without passing through consecutive fever of any kind, was by far more frequent in India than at St. Petersburgh, a statement which, while it asserts the increased frequency of fever, certainly implies that restoration to health sometimes takes place without its occurrence. Now we can positively assert that we have not met with a single case in England, in which fever did not intervene between the choleric or cold stage and restoration to health; and the result of inquiries we have addressed to individuals the most observing and most familiar with the disease in this country, has proved that their experience has coincided with our own. It is true that in some cases this fever has been slight, but the choleric stage has been so likewise; *for we have always observed a correspondence in intensity between these stages.*

Were we to attempt a definition of epidemic choleric fever, the following, according to our experience, would comprise its distinctive symptoms.

After watery diarrhœa, or other generally slight indisposition, vomiting and purging of a white or colourless fluid, violent cramps, great prostration and collapse,† the last occurring simultaneously with the vomiting and cramps, or shortly after them. Should the patient survive the last train of symptoms, a state of excitement and fever supervenes.

We can convey a correct idea of the disease only by dividing it into three stages, *the incipient, the cold or choleric, and the febrile:* the division is a natural one, according with the character of the disease.

1. **Symptoms of the Incipient Stage.**—In an immense majority of instances, diarrhœa has been the prominent symptom of this stage. Languor and lassitude, and occasionally nausea and vertigo coexisted with the disorder of the bowels, and sometimes certain of these symptoms may have appeared without it; but its occurrence has been so common, that we have treated few cases in which it has not preceded the more formidable symptoms. On examining the discharges, if we have an opportunity of doing so shortly after the occurrence of the diarrhœa, they will be observed to be fœcal and bilious, but we shall find that they subsequently bear the serous character of those which occur after the choleric stage is fully formed; they are passed copiously and without much griping; the feeling of debility which attends them is great, and this diarrhœa is so exhausting, that we have met with patients, especially those advanced in life, in whom a considerable degree of collapse had occurred, with a feeble pulse scarcely exceeding fifty, before the accession of vomiting and cramps. The natural tendency of this purging, is, we believe, to pass into the choleric stage; but the transition has frequently occurred shortly after some dietetic error, either as to quantity or quality of food, or after exposure to cold. The commencement of the purging has sometimes preceded by several days the accession of the choleric stage, and occasionally only by eight or ten hours; but forty-eight hours has been its mean duration, calculated from a great number of instances. We have dwelt the more on this incipient stage from a conviction, the result of considerable observation of the disease, that subsequent symptoms might often be prevented, and life preserved, by the early and appropriate treatment of the diarrhœa.

[The premonitory symptoms, consisting of more or less derangement of the digestive functions, with diarrhœa to a greater or less extent, were generally termed *cholerine*. The appellation was also given by some, both to the premonitory and to the incipient stage.]

2. **Symptoms of the Cold or Choleric Stage.**—Our description will be more intelligible if we divide into two periods this very important stage, which has in truth given its name to the

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* For further information on this point consult Dr. Negri's Letter to Dr. Barry; Morton, Pyretologia, pp. 16, 33, 81; Torti de Febribus, lib. iii. cap. i. p. 194; and Med. Essays, by J. Brown, M. D. pp. 37–39.

† By *collapse*, in this definition, is meant the feebleness or almost the arrest of the circulation; the death-like appearance, the coldness, shrinking, and occasional blueness of the surface, which may in other diseases be observed after they have existed some time, and as the powers of life are passing away; but which occur in what we shall call the cold or choleric stage of the epidemic, in a short time after its commencement, as though they formed an essential part of it. The degree and early accession of this collapse, and the white discharge, are the only distinctive marks that we are aware of between this stage of the epidemic and ordinary cholera.

disease, and, by its fearful symptoms, has engrossed such general attention, that the facts of its being but part of a series of changes has been too often lost sight of.

First period.—The time of invasion has been, as in India, in a great majority of instances, from two to four o'clock in the morning. The patient is attacked with uneasiness of the stomach, occasionally amounting to pain, to which speedily succeeds vomiting of the characteristic fluid so frequently described; and, if diarrhœa have preceded, which in almost all the cases that have fallen under our observation has been the case, a purging of the same fluid, the fœcal contents of the canal having been previously expelled. The vomiting is rarely full and effectual, consisting rather of apparently unsatisfactory retchings than of a full discharge of the contents of the stomach; but sometimes these contents are expelled forcibly, as if squirted from a large syringe. The discharges from the bowels are occasionally scanty, but much more frequently they take place copiously and forcibly. Simultaneously with the vomiting, or not unfrequently before this symptom has occurred, cramps take place, and the agony which attends them constitutes great part of the sufferings of the patient, who incessantly entreats that friction may be applied to the parts they affect. However soon our visit may be made, the *pulse* will generally be found to be feeble and frequent; the skin in point of heat below the healthy standard; the countenance shrunk, and, if not livid, pallid; and the respiration hurried, if not checked, as it frequently is, by spasm of the diaphragm and intercostal muscles. The circulation sinks remarkably, and sometimes appears momentarily to cease, on every occasion of severe vomiting or spasm.

Second period.—The mean duration of the preceding period varies from about eight to twelve hours; the vomiting and spasms then either totally subside or recur at much longer intervals, and the patient sinks into a state of extreme collapse. The pulse at the wrist is scarcely or not at all perceptible; the surface is universally moist and cold, excepting as heat is imparted from without, for the instant that the hands or other parts are exposed, they become of an icy coldness; blueness, if it exist at all,—but it is by no means an uniform symptom,—is now conspicuous on the face and hands, which last have the shrunk and soddened appearance so generally described; the tongue is moist, and, if not actually cold, at least cooler than natural; and the voice is of that mingled huskiness and feebleness which strikes the ear so peculiarly. In this condition there is little suffering, excepting from the sense of weight and oppression at the præcordia, of which the patient complains much; for even should spasms occur, they are now too feeble to excite much pain; the respiration is slow; the conjunctivæ, especially in their inferior hemisphere, are frequently injected with dark-coloured blood; and the insensibility of the stomach is so great, that the most powerful stimulants may be given and retained without the organ being apparently more sensible of their presence than if it were a lifeless pouch. The urine is suspended throughout the whole course of a choleric stage so intense as we have described.

However hopeless such a state might appear, we have seen more than one patient emerge from it by the powers of the constitution, to have a faint chance for life in a very bad form of fever, after all the efforts of art had proved ineffectual for bringing on reaction. We have seen this apparently spontaneous transition into the febrile stage take place after the patient had remained for many hours without any perceptible pulse at the extremities.

Premising that the danger in the cold stage, and the degree and malignancy of the subsequent fever, are in proportion to the collape which is observed in this stage, we shall depict one of the lighter cases which occurred during the epidemic, remarking that the shades of intensity in the disease are so infinite that its intermediate degrees must be supplied by clinical observation.

In one of the milder cases extreme collapse does not take place. Whether by the powers of the constitution, or the remedies employed, there is a subsidence, after a period varying from eight to twelve hours, of the cramp and diarrhœa; the patient becomes calm and composed, but appears rather low and sunk; the stomach remains irritable, occasionally retaining, occasionally rejecting, food or medicine administered; the skin becomes of a moderate warmth, but yet is cooler than natural, and a good deal of adventitious heat is required; the pulse emerges to a condition of moderate force, without much frequency, being probably about eighty, and soft; the urinary secretion, if it has been suspended during the spasmodic period, which it is not always in the milder cases, is restored; after the lapse of a few hours, should vomiting occur, bile is perceptible in the matters vomited, and, generally by the assistance of calomel or other laxatives, bilious stools are discharged.

The transition from such a case is into a mild inflammatory fever, generally with some affection of the head; from which the patient recovers in a few days, by measures to be subsequently adverted to.

3. **Symptoms of the Febrile Stage.**—The preceding stage, in most instances, makes a very gradual transition into the present one. After the patient has remained in the collapsed state probably for a considerably longer time than the medical attendant expected, some degree of warmth will be found returning to the surface, which for a variable period, perhaps for a couple of days, has been almost of icy coldness; and the pulse is proportionably developed, being very perceptible at the wrist, generally about eighty, and soft; the vessels of the conjunctiva gradually become distended with blood; or if those of the inferior hemisphere have been so during the stage of collapse, the distension now diffuses itself over the whole membrane; the patient, who on his attention being roused is perfectly sensible, complains of severe pain in the head, of a sense of giddiness, and that the light distresses his eyes. The tongue in this early stage is clean and moist; the bowels are readily acted upon by medicine, and the discharges are feculent, and though somewhat

clayey, contain a proportion of bile; but the urinary secretion is sometimes either not restored, or is considerably deficient for a day or two after the establishment of fever. In the progress of the fever the tongue becomes black, and sordes accumulate about the teeth; the eyes become more and more injected; the intellect more and more torpid, though still the patient can be roused to answer questions, and even may make one or two sensible remarks on his condition; but the instant the conversation ceases, the eyes are turned up in the orbit, exposing through the half-closed eyelids the red sclerotica, and the patient is in a state of profound stupor: the urinary secretion is now established, and the urine, which at first was dark-coloured and cloudy, is now limpid and pale; the alvine discharges are darker coloured than at first; and throughout the disease there is a deficiency of vascular action and of temperature, which we have not observed to the same extent in typhus or any other fever. However flushed the countenance may appear, and it is often very considerably so, the temperature of the surface is below the healthy standard, and we have not often found the pulse above ninety. *Typhoid* is not an inappropriate designation of the condition we have endeavoured to describe; but we think that an individual who had once watched the progress of such a case would run no risk of confounding it on future occasions with typhus;—the deficiency of vascular and calorific power; the peculiar vascularity of the eye; the absence of subsultus and muttering delirium, (for though delirium occasionally occurs during night, the condition of the intellect is throughout much more one of torpor than of irregularity,) would be the marks by which he would discriminate the two affections.

The duration of such a febrile stage as we have described is from a week to ten days. Its termination has been in a considerable majority of instances, which have fallen under our observation, fatal. The brain has appeared to us to be the organ mainly affected, and by this view our treatment has been chiefly guided, though at the same time the condition of the intestinal canal has not been neglected.

In another form, and one which supervenes on a minor degree of collapse than the preceding, the symptoms do not differ from those described above, excepting that there are indications of greater excitement, more warmth of surface, and more force and frequency of pulse. Depletion could be more freely practised, and it was altogether a more tractable form of disease.

The mildest and most tractable type of the febrile stage was denoted by symptoms of general but moderate excitement with epigastric pain on pressure, headach, and giddiness; the tongue being at the same time either clean, with a disposition to become dry and glazed, or slightly white and furred; the skin warm; the pulse free and forcible; the urine high-coloured, and the thirst considerable. In such a case there is little or no confusion of thought or delirium, and the eyes are not injected. We need scarcely remark that examples of this mild and tractable type of the febrile stage occurred after a choleric stage, in which the symptoms of collapse had been inconsiderable, in which the urinary secretion had not been suspended, or which had not always been attended with vomiting, a symptom occasionally wanting in slight cases.

The writer met with but one example of considerable affection of the thoracic organs, and this occurred in a case in point of general character not unlike the form last described, though somewhat more collapsed. The affection was bronchial, and was relieved by a copious expectoration of very dark-coloured sputa,—the patient recovering.

In the preceding sketch of the febrile stage, it will be understood that, as in the case of the choleric stage, we have not attempted to depict all the various shades of intensity in which the disease manifested itself. The extremes are given: to have essayed to describe all the intermediate degrees would have swelled the article beyond reasonable limits, and would have proved a burthen to the memory of the reader, rather embarrassing than beneficial at the bed-side.

The varieties in the different stages which we have left to be discerned clinically by the reader were, it ought to be remarked, essentially the same in character with the forms we have depicted, differing only from them and each other in shades of intensity more or less minute; but there were cases observed in Sunderland, as in India, of which the character constituted so considerable a deviation from the ordinary type, that our description would be incomplete did we pass them unnoticed.

In one such deviation from the usual type, the discharges were bilious during the choleric stage, which, in fact, could not be discriminated from an attack of ordinary cholera; a mild and tractable form of fever ensued, and the patient recovered. One case of this kind occurred under the following circumstances. The wife died of what was then designated malignant cholera. The order for prompt funerals did not at that time exist; and on the day of her interment, three days after her death, the husband sickened of the form of disease we are now describing, and recovered after a few days of fever.

We witnessed a solitary example of a form of disease which has been particularly described by Mr. Orton, as being occasionally intermingled with the customary type of the malady in India. In our case there were trismus, and spasms of the muscles of the throat so violent, that, till they were allayed by bloodletting, swallowing was impracticable; and when it could be performed, it was done with an effort resembling that with which a patient in hydrophobia swallows water, after having, by a strong mental effort, brought himself to make the attempt in spite of his abhorrence of it. It ought to be remarked, however, that there was no dread of water, nor any characteristic symptom of hydrophobia—the resemblance was merely in the manner of swallowing. The patient was in an excited state throughout the disease, which was of twenty-fours' duration, till within two hours of death, when collapse occurred. The complaint commenced with vomiting and purging; the matter vomited we were informed was colourless; that discharged by purging we learned was at first rather yellow; but the intestinal discharge which we saw, after the complaint had lasted some hours, was colourless and mucous. This being a solitary case of the kind, and fatal in the stage which we considered as corresponding with the choleric stage of the ordinary type, we had no opportunity of ascertaining whether any or what form of fever would ensue.

3. **Prognosis.**—The danger of the disease is in all cases, we believe, to be estimated from the degree of collapse attending the cold or choleric stage. In India, it was remarked that the cases in which the spasms and vomiting were the most violent were by no means fraught with the most peril, and what we have seen of the disease enables us to bear testimony to the accuracy of the remark; for when we have heard attendants exulting in the cessation of the spasms and the facility with which the stomach retained medicine or food, and have felt at the same time the pulseless wrist and the cold and clammy hand, we have seen in these apparently favourable omens only the natural progress of the disease from a bad condition to one still worse. Whether we are to dread a fatal result in the cold or the excited stage, the intensity and duration of the collapse in the former of these stages are the measure of the danger; for if the patient die in this stage, he dies of collapse, and if he survive it and pass into the state of fever, the character of this fever is malignant and dangerous in proportion to the same collapse.

4. **Diagnosis.** — From ordinary cholera the cold stage is to be distinguished, as it appears to us, by the peculiar character of the discharges, which has been sufficiently dwelt upon, and by the degree of collapse and its early occurrence. Cases have been adverted to, which, at least in the choleric stage, could not be discriminated from ordinary cholera, excepting perhaps from their taking place at a season of the year when ordinary cholera is never observed; but it may be remarked that no one would infer the existence of the epidemic from such cases, though he might be disposed to acknowledge that they belonged to it, if cases less equivocal were simultaneously prevalent, and especially if they originated under the circumstances mentioned in the preceding page.

Notice has been taken of sporadic cases which have occurred in several parts of the kingdom during the last year, and which have been reported in various publications. We have already stated our opinion as to the perfect identity of the group of symptoms in certain of these cases, and those which characterise the choleric stage of the epidemic. These cases have generally been fatal as cases of cholera, and probably on this account have attracted attention and been reported; and hence what we should consider the *experimentum crucis* by which their essential alliance to the epidemic, as it has manifested itself in this country, or difference from it can alone be proved,—the intervention, or otherwise, of fever between the cold stage and recovery,—is necessarily wanting. We have been favoured by a gentleman of high character and attainments (Dr. Fenwick, of Durham) with a report of two cases regarded, at the time they occurred, as aggravated cases of the ordinary disease; both took place in the interior, under circumstances in which there was not the slightest ground to expect contagion, and previously to there being any suspicion of the existence of the epidemic in this country. In one, the symptoms bore, unquestionably, a considerable resemblance to the choleric stage of the epidemic, but no fever supervened. The symptoms of the other shall be given in the words of the writer.—"The total, or nearly total suspension of the secretion by the kidneys; the watery vomiting and stools; the severity of the spasms; the shrunk and corrugated state of the skin on the hands and feet, and the blueness of his nails, persuade me that his disease was of the spasmodic type. In him, moreover, a slow fever succeeded the original symptoms, and long retarded his recovery." We need not remark that we would not attempt to discriminate between such a case as this and examples of the epidemic, believing their character to be identical. This case occurred in the beginning of July, 1831.

There is a certain form of the febrile stage, that which supervenes on a choleric stage, attended with extreme collapse, which the deficiency of the temperature and the circulation, the congested state of the conjunctiva from the very commencement of the fever, and the peculiar torpor of the intellect, would enable, as it appears to us, the observer to discriminate from any fever which we are in the habit of witnessing in this country, provided he saw the patient early and watched him throughout; but in the majority of instances the diagnosis can only be correctly drawn by coupling the preceding history of the case with the existence of fever, and with its character.

5. **Appearances on Dissection.** — The external appearance of the body closely resembles that which has been noticed during life: the solids are shrunk, the surface is livid, the skin of the hands and feet is corrugated, the nails are blue, and the fingers often rigidly contracted. There is no evidence of any unwonted tendency to putrefaction, nor any characteristic fœtor from the abdominal cavity.

In the *head* are found marks of congestion, and even occasionally of extravasation. Such appearances were not of uniform occurrence in the dissections performed in Hindostan, but they were found very constantly in those made by Dr. Davy, in Ceylon; and Dr. Keir, of Moscow, discovered in the Russian disease the blood-vessels of the brain and its membranes more or less turgid with blood, particularly towards the base, with a fluid effused into its convolutions, and more or less of serum in the lateral ventricles.

In the *thorax*, the pleura and pericardium are found, as the serous membranes generally are in this disease, perfectly healthy, with the exception occasionally of an unusual dryness. The lungs are sometimes in a natural state, but more frequently gorged with dark-coloured blood, so as to resemble liver or spleen; or they have been found collapsed on each side of the spine, leaving the thorax nearly empty. This latter appearance Dr. Pollock, of the fifty-third regiment, explained by supposing gas to be extricated within the cavity of the pleura; but the thorax having been opened in such cases under water, and no air having been found, Mr. Scott is disposed to ascribe it to a contractile power exerted by the viscus, sufficient to overcome the atmospheric pressure. Both sides of the heart are in general distended with dark blood, and the bronchi are frequently filled with mucus.

In the *abdomen*, the vessels of the liver are often much congested, and pour forth blood copiously when incisions are made into the organ; but this congestion is not uniformly found; the gall-bladder is turgid with black bile, and its ducts are sometimes constricted and impermeable, though occasionally in an opposite state. The peritoneum is often quite healthy, but the portion investing the alimentary canal has frequently an inflamed appearance from the exceedingly loaded state of the blood-vessels. This congestion is sometimes so great as to give the appearance of gangrene; but by drawing the finger over the surface, innumerable small veins may be found running in every direction, as in a preparation nicely injected, and the texture is found to be resisting and firm. This portion of the peritoneum, however, occasionally bears marks of actual inflammation, especially if the patient has lingered long before death. It then presents a thickened appearance externally, and its colour varies from a pale vermilion, through all the deeper shades, to a dark purplish hue; the former being chiefly remarkable on the surface of the duodenum and jejunum, the latter on the ileum where it terminates in the cæcum. At other times, the whole alimentary tube, instead of this congested state, presents a blanched appearance both internally and externally. The omentum is sometimes healthy; at others, it presents the same appearance of extreme vascularity as the peritoneal surface of the alimentary canal.

The following appearances are discovered on laying open the stomach and intestinal tube. A white, opaque, and viscid substance is found adhering to the surface of some portions of the mucous membrane; and in many cases it is so abundant in the intestines as completely to fill parts of them of a greater or less extent. The stomach and portions of the intestines are filled with a transparent or turbid serous fluid, and frequently the viscid matter mentioned above is found intimately mixed with the serous fluid, or floating in it in the form of flakes. The mucous membrane, except when inflamed, which it not unfrequently is, has an unnatural whiteness, is often soft and pulpy, and in general—especially in the stomach and small intestines—can be easily detached by scraping, in the form of a thick pulp, from the subjacent coat. These appearances are sometimes more or less partial; but some of them are generally found throughout the whole extent of the tube. They extend in some cases to the mucous membrane of the bladder and ureters, and have been found in two or three instances in that lining the bronchi.

In one case only in India was the state of the spinal marrow examined; and in that, strong indications of inflammation were detected in its sheath; the case, however, was in some degree a mixed one. But Dr. Keir found, at Moscow, the blood-vessels of the vertebral column and spinal chord more or less loaded with blood, which was sometimes effused between its arachnoid and dura mater; partial softening of the substance of the spinal chord was sometimes met with, and marks of inflammatory congestion in the larger nerves were detected.*

The dissections performed in Sunderland have generally furnished results corresponding with those obtained elsewhere.

In the *head*, venous congestion of the brain and its membranes has been the most uniform and prominent appearance. Serum has been found in the ventricles of the brain and at its base; but in many cases this has been in small quantity, not exceeding that frequently observed after diseases in which no affection of the encephalon was supposed to exist. In some cases, especially those in which death took place in a protracted stage, but occasionally in a rapid disease, fibrinous depositions existed between the membranes.

In the *thorax* the lungs have uniformly been found more or less gorged with blood, though in many cases the engorgement was in the posterior part, and probably resulted from position. These organs were generally crepitating, and free from structural change. Softness or flabbiness of the heart has been noticed in several instances, and both its cavities and the venæ cavæ and coronary vein have been distended with dark-coloured blood.

In the *abdomen*, the liver has been found gorged, but occasionally its condition was natural. The gall-bladder was generally distended, and the ducts were constricted, so that the viscus could not be emptied by pressure; but in some cases they were pervious. The abdominal veins have been found generally distended; but in several instances, the vena portæ and mesenteric veins have constituted an exception to this rule, having been found empty. Vascularity and pulpiness of the mucous lining of the stomach have been frequently noticed; but the former has often been slight in degree, and observers have felt disposed occasionally to attribute it to the exhibition of mustard or other stimulants; whilst the latter has by no means been invariably found. The lining of the intestines has been found in many parts vascular and pulpy; but these appearances are not invariable, both lesions having been found wanting, and the pulpiness more frequently than the vascularity. The peculiar secretion has generally been found in the intestines.

The kidneys have been observed to partake of the general congestion of the venous system. The bladder has generally been found contracted, and either empty or containing a small quantity of urine. In the case mentioned, which was attended with trismus and other peculiarities remarked in India, but not in other examples of the disease in Sunderland, it was considerably distended.

No softening or other disease of the spinal marrow, a little venous congestion excepted, was discovered in the few examinations of this organ made here.

In concluding this rather unsatisfactory portion of our subject, we cannot refrain from expressing a conviction that symptoms during life throw much more light on the nature of the disease and its appropriate treatment than appearances after death.

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* Madras Reports, pp. 32, 34. *Anderson* on Cholera Morbus, Edinburgh Medical and Surgical Journal, vol. xv. *Christie* on Cholera, p. 47. *Annesley*, Diseases of India, 2d edit. p. 106, et seq. Account of the Appearances after Death observed at Moscow, drawn up by *Dr. Keir*.

6. **Nature of the Disease.**—Many writers of great talent have preceded us in this very intricate branch of the subject, and much ingenuity has been displayed in the endeavour to trace all the phenomena of the choleric stage, which has been the principal subject of investigation, to a change in one part of the system. But it must be remarked that there is little accordance among medical reasoners as to the part of the body in which the phenomena of the disease are presumed to originate; for the nervous system generally, the ganglionic portion of it exclusively, the blood itself, and the lining of the digestive canal, have each found advocates equal in ability to plead their cause.*

The diversity of these views is a proof of the intricacy of the subject; and probably also, since they have all emanated from observing and ingenious men, an evidence of the variable nature of the disease; each reasoner being perhaps influenced by that portion of the general phenomena of the epidemic which predominated in the cases it was his lot most frequently to witness. Their partial nature, too, may be in a considerable degree ascribed to the unfortunate influence of the expression, *proximate cause*, as a substitute for the more comprehensive term, essence or nature of the disease, on medical reasoning. Even those who affect to use it as an equivalent term for *nature of the disease*, are yet insensibly influenced by the words they employ. Amidst the crowd of phenomena presented to their notice in certain maladies, they often assume, on very insufficient grounds, that some one fact is the original of all others, and this they invest with the title of proximate cause.

If the facts related respecting epidemic choleric fever are compared with the explanations offered of them, it will be found that each medical reasoner has attributed the commencement of the phenomena of the disease to an affection of some part of the frame, which affection unquestionably exists in a very great number of instances, but neither with that uniformity nor with that priority of time which can warrant us in concluding that it was the cause of all the other symptoms. It seems a rational supposition that the remote cause of a disease may act, in some instances, first on one, in others on another part of the system, from some local weakness or peculiarity of individual constitution, or from some specialty in the mode of application of the cause; and yet that the disease shall retain in each case such a resemblance to a common type as shall prove its identity. It is likewise supposable that the remote cause may make a simultaneous attack on more than one organ or part of the system. Complex diseases, such as fever, appear to furnish examples of both these cases. The real philosophy of medicine seems to consist in ascertaining the actual state of the system of which symptoms are the signs; and if we can proceed through the medium of these signs and post-mortem appearances, to one sole change in one organ, the treatment is simplified, and science and art are gainers. But there are diseases, and this seems to be one of them, in which we meet with a variety and complexity of pathological conditions, all of importance, and all to be kept in view in their treatment. It is true that of these conditions some may arise from others according to known physiological laws, as dark-coloured blood from impeded respiration, and it is right thus to explain them when possible; but the uniform endeavour to trace all to one primary change, or rather, as is more frequently done, to assume one change to be primary, and all other morbid states to be but emanations from it, is not only unphilosophical, but is too apt to tinge our practice with undue partiality.

Whilst we deem that no one writer has attained, either by inferences drawn from symptoms, appearances after death, or both, a knowledge of the affection of any one organ in cholera which can be properly termed a proximate cause whence all the other phenomena arise; or acquired precise ideas respecting the nature of the affection of many organs which manifestly participate in the disorder; it is gratifying to acknowledge that their labours have thrown much light on the condition of many parts, and that very great practical good has resulted from the information thus obtained.

That the nervous system generally, and especially the ganglionic and spinal nerves, and the spinal medulla itself, are affected, is manifest from many symptoms; but whether this affection arises from a direct impression of the remote cause of the disease on these organs, or from irritation propagated from the alimentary canal along the ganglionic nerves to the spine, we are ignorant. Dr. Kier's able researches have shown that in some fatal cases inflammation of a portion of this system has existed; but its precise pathological condition in cases which terminate favourably remains yet to be ascertained; and it must be remarked, too, that in fatal cases this inflammation has not been always detected. The state of the sanguiferous system is very remarkable: but here too we must feel some doubt whether the feebleness or almost complete arrest of the heart's action is a primary effect of the cause of the disease, or, as suggested by Mr. Bell, arises from the affection of the ganglionic system; or, again, whether it results, through the medium of this system, from the condition of the alimentary canal. Is the dark appearance of the blood to be explained by the feebleness of the action of the right ventricle, as a consequence of which but little blood is transmitted through the lungs and exposed to the influence of the air? According to this view, which is suggested with diffidence, the imperfection of the respiratory process will arise from the same cause as in congenital malformation of the heart, such as the persistence after birth of the foramen ovale, or the aorta arising from both ventricles, in which a very small proportion of the whole mass of blood is oxydized. This hypothesis explains readily the dark appearance of the blood, its accumulation in the great veins of the viscera, the coldness and lividity of the skin, and the imperfection of the respiratory process, which has been so ably illustrated by Dr. Davy. This gentleman was the first to show that the air expired by patients in the choleric stage is colder and contains less than the usual proportion of carbonic acid; and that this is the case even when the breathing is full, free, and rapid. The explanation offered is confirmed by an observation of Mr. Ellis, in his experiments on respiration, that "as the circulation declined, so likewise did the emission of carbon, and, consequently, the production of carbonic acid." The thickened consistence of the blood receives a ready explanation from the loss of its serous part by the abundant discharge from the inner intestinal surface.

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* These are Dr. Kennedy and Mr. Orton for the first, Mr. Bell for the second. Mr. Annesley and others for the third, and Mr. Christie, with Roche and other French writers for the last.

There are two morbid conditions of the lining of the digestive canal. In one it is in a state of manifest inflammation; in the other it is white and pulpy, and easily detached from the subjacent coat. Is this latter condition the result of a disorganizing inflammation which has itself passed away, or must we be content to describe the action which has produced it by the very unsatisfactory and vague expression, disturbance of the function of nutrition? This is a question rather of general pathology than one connected solely with this disease; but it is one as yet undecided. The affection of the alimentary canal is essential and primary, if any part of the disease is so; and it were vain to attempt to trace it to a morbid condition of any other organ or system of organs.

[The German and French physicians have paid considerable attention to an eruption of isolated granular pimples, chiefly met with in the two lower thirds of the ileum, which is said to exist in the vast majority of cases. Owing to this eruption, MM. Serres and Nonat gave the disease the name *psorenteria*. (Art. *Cholera*, par A. Nonat, in *Dict. des Études Médicales*, tom. iii. p. 416: Paris, 1839.)

Examination of the blood of a choleric patient by M. Andral, (*Hématologie Pathologique*, Paris, 1843,) showed that there was no augmentation of the fibrinous element, as is observed in severe phlegmasiæ of the digestive tube. The proportion of fibrin was 3·3; of globules 118; and of solid matter of the serum 88.]

The general suspension of secretion, which is complete only when the collapse is extreme, appears to result from the disorder of those systems, the nervous and vascular, on which this important function depends. The apparent anomaly presented by the continuance of the cutaneous and intestinal discharges amidst the general suspension of secretion, is well explained by Mr. Bell's distinction between this function and exudation or exhalation. (Treatise on Cholera Asphyxia, p. 56, 57.)

Were we to endeavour to illustrate in a few words the nature of cholera by examples drawn from analogous diseases, we should say that its choleric stage presented in a more intense degree the initiatory collapsed symptoms of certain bad fevers before re-action had taken place, combined with excessive gastro-intestinal irritation; whilst the febrile stage bore a very close resemblance to such fevers after the establishment of re-action, or in many cases was, at least in external character, perfectly identical with them.

That the whole series of phenomena results from the action of a morbific poison on the body, there can be no doubt; but as yet, as in the case of other fevers, we are ignorant of the precise nature of the primary change effected by it in various organs or systems; and it is to be feared that till more accurate ideas are attained respecting the pathology of fever in general, this ignorance will remain. In the febrile stage, we would remark, there are indications by no means equivocal, of inflammatory affection of the brain, and occasionally of other organs, the analogy to fevers in general being in this respect preserved. Were we to judge solely from what we have ourselves observed of the commencement of the disease, we should consider the alimentary canal to be the part of the frame which first felt the influence of the poison; but we should consider the condition of the nervous and vascular systems much too intense in degree to be merely sympathetic of the state of the stomach and bowels. Many cases, moreover, which have been reported from abroad, particularly from India, lead to the opinion, that in various instances the nervous system is primarily affected.

5. **Proportionate Mortality.**—The mortality during the early prevalence of the epidemic in India in 1817 and 1818 was very great, but either from the abatement of the intensity of the disease, or from the improvement of the method of treatment adopted by our medical men, or, as is more probable, from the co-operation of both these circumstances, it was subsequently very much reduced. There is no disease in which unassisted nature seems more powerless than this. We learn from the report to the Medical Board at Bombay, that there is reason to believe that of 1,294 cases which received no medical assistance, every individual perished; and it is added, that it is not ascertained that any case has recovered in which medicine had not been administered. From this appalling statement, it is gratifying to humanity to turn to the following records. According to the documents collected by the Madras Medical Board, the number of deaths caused by it in the army of that presidency during 1818 and the four subsequent years, was 4,430, of which 695 occurred among the European troops, and 3,735 among the sepoys. The number attacked was 19,494, namely, 3,664 Europeans and 15,830 natives. The average strength of the army during the period included in the reports being 10,113 Europeans and 73,254 natives, it follows that in five years 23⅓ per cent. of the troops were attacked, and that of these 22¾ per cent. were carried off, or 5⅓ per cent. of the whole force of the army. This statement, though sufficiently distressing, is still a proud monument to the skill of the medical men employed, and to medical science in general.

We hear, in different situations, of rates of mortality infinitely lower than this. Dr. Burrell, surgeon of the 65th regiment, reports, for instance, from Seroor, that out of sixty cases he lost four, being at the rate 6·6 per cent.; whilst Mr. Crow, at the same station, makes the mortality much less, declaring that the disease is not fatal in more than one in a hundred of those who are early succoured. Dr. Burrell found, too, that of a cartain description of cases, those attended with violent spasms, he saved eighty-eight out of ninety. (Bombay Reports, p. 68, &c.) In taking these estimates into consideration, we must always recollect, however, that in epidemics there is often a very wide difference in the gravity of the disease at different points or in different years,—indeed, sometimes at nearly the same point and in the same year; so that when we hear of an extremely small loss in proportion to the number attacked, long experience does not permit us to doubt that in such a case the type of the disease has been very mild.

The ravages of the disease in civil life, amid a comparatively unorganized population, where prompt assistance could not always be rendered to the sufferers, furnish a considerable contrast to this statement from the British army, and strongly confirm the opinion expressed, of the importance of early treatment in a malady so rapid in its course, and in which the efforts of nature are so impotent.

At Busheer, in the Persian Gulf, we learn from Moreau de Jonnés, that in 1821 a sixth part of the inhabitants perished; and at Bassora, in the same year, Mr. Rich informs us that eighteen thousand died, of whom fourteen thousand perished within a fortnight. The number attacked in Moscow from September 1830 to January of the following year, was 8,130, of which perished 4,385, or 54 per cent.* In the small town of Redislscheft, of eight hundred sick, we learn from Dr. Reimann, that seven hundred died in one week. The greatest success which has attended the treatment of the disease in the Russian empire, so far as the records have reached us, occurred in the district of Orenburg, the number attacked being 3,590, of whom 865 perished, or about $24\frac{1}{18}$ per cent., a result creditable to the vigilance of the Russian government, and to the skill and care of the medical men employed. The treatment adopted was that of our Indian practitioners; bleeding, calomel, opium, warmth, and friction.†

The disease having, there is every reason to think, run its course through the town in which these observations were written, it may not be uninteresting to mark the amount of ravage which it has inflicted.

The town comprised under the general name of Sunderland consists of three parishes, viz.

	Inhabitan's.
That of Sunderland, containing....	17,060
Bishopwearmouth...............	14,825
Monkwearmouth and its immediate dependencies, in all which the disease existed..................	8,850
Total..........	40,735

This computation is exclusive of certain out-townships, to which the disease did not extend.

The total number attacked with epidemic choleric fever out of this population from its manifest appearance on the 26th of October to its cessation in the middle of January, was 534, of whom 202 perished. These deaths are computed, with all the accuracy which the parish registers and other sources of information permit, to have occurred in the following proportions:—

In Sunderland....................	156
In Bishopwearmouth...............	21
In Monkwearmouth................	25
Total............	202

From this statement it is manifest that, if the disease pursue the same course elsewhere that it has done in Sunderland, the danger to a population is to be estimated less from their numbers than from various circumstances in their condition, and particularly from the proportion which the labouring class bears to the rest of the community; for the parish of Sunderland, in which the mortality was in so much higher a ratio to the population than in the other parts of the town, is that in which the proportion of the labouring poor is greatest; though their situation is by no means so comparatively wretched as persons unacquainted with the habits of the labouring class in general, (and especially of that portion of it dwelling in sea-port towns,) and consequently destitute of the means of accurate comparison, have taken pains to describe. Besides the smaller number of the labouring class residing in Bishopwearmouth, there are various circumstances, such as its situation being higher, its streets wider and better ventilated, &c. which probably contributed to its proportionate exemption from the disease. Of the small number of its population who suffered, it must be remarked, moreover, that a large proportion lived in an inconsiderable part of the parish, at its outskirts near the river, called Ayre's Quay, inhabited almost exclusively by the labouring class. In this small locality nine out of the twenty-one deaths occurred. It should be observed, too, that in Monkwearmouth, situated on the north bank of the Wear, the disease was confined almost exclusively to the lowest, dirtiest, and most populous district, situated near the river, called *the shore*.

It is a fact of some importance that of the victims of the disease, seven only, so far as we have been able to discover, were, in point of situation in life, at all above the labouring class.

A simple calculation shows that the mortality amounted to one in two hundred and one and a fraction of the whole population in which the disease prevailed; that of Sunderland was as one to about a hundred and fifteen of its population; that of Bishopwearmouth as one to seven hundred and six, and exclusive of Ayre's Quay, as one to somewhat more than one thousand; and that of Monkwearmouth as one to three hundred and fifty-four.

There is nothing very alarming in such a rate of mortality as we have described; it is high on the number attacked, but low on the amount of population: and the former circumstance and the rapidity of the disease will probably be found to constitute its most appalling features, if its course elsewhere in this country resemble that observed here. Other epidemics which visit us exceed it, whether we regard the number or the quality of victims, in the amount of evil inflicted; but none is to be compared with it in fatality in proportion to the number attacked, or in the rapidity with which it accomplishes the work of destruction.

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* Memoir of *Dr. Loder*, physician to the Emperor at St. Petersburgh, dated January 1831, and read at the Academy of Medicine at Paris.

† Substance of a report published by the Supreme Medical Board of Russia.

Our friend Dr. Ogden has furnished us with the following calculation, which is interesting provided the results of similar calculations made elsewhere in this island correspond with it; for it will thus be shown that in one point of some importance, the proportion of the sexes attacked, the disease here observes a course directly the reverse of that witnessed elsewhere in its progress.

Cases of cholera, known to be such, buried at Sunderland between the 28th of October and 22d of December:—

AGE.	MALES.	FEMALES.	TOTAL.
15 and under....	12	13	25
From 15 to 50...	14	33	47
Above 50........	37	36	73
	63	82	245

Besides showing that at the period of middle life the number of female victims of the disease is double that of males, and that at the two extremes the numbers are as nearly equal as possible, this table shows how large a proportion of aged persons the whole amount of mortality comprises, these constituting more than one-half of the total of deaths.

The preponderance of attacks in females over those in males at the period of middle life is probably to be explained partly in the manner suggested by Dr. Ogden, that the dress of the latter sex furnishes a better security against cold than that of the former; and in part by the circumstance that males at the working period of life are better nourished than females, being frequently the only members of families of their class of society who partake of animal food.

For obvious reasons, we abstain from any statistical details connected with neighbouring towns in which the disease is, at the time this is writing, only in progress.

[From some estimates made in England by Sir David Barry, it would appear that 38·6 per cent. of the cholera patients died. In 1832, probably 5000 perished in London, and in Great Britain somewhat more than 20.000. In Paris, during the epidemic of 1832, more than 18,000 fatal cases are said to have occurred. In the Russian provinces, the mortality was 58·6 per cent. In Naples, it was estimated at six to ten. In Palermo, it was dreadful. Of a population of 150,000, about 30,000 of whom, it was supposed, left the town at the breaking out of the complaint, 25,000 died, or about a fifth part of those who remained. In some of the towns of the United States, the mortality was taken as accurately as was practicable. It is thus stated by Professor Jackson, of Philadelphia:

Places.	Population.	Cases.	Deaths.	Ratio of cases to population.	Ratio of deaths to cases.	Ratio of deaths to population.
Quebec,.........	32,000	5783	3292	1 in 5+	1 in 2·5	1 in 10·5
Montreal,........	28,000	4385	1853	1 in 6·5	1 in 2·5	1 in 15+
New York,......	240,000	5547	2782	1 in 25·3	1 in 2	1 in 15·5
Philadelphia,.....	160,000	2314	936	1 in 70	1 in 2·5	1 in 173·2

From the epidemic at Paris, attempts have been made to calculate the probability of death and recovery in Asiatic cholera. From these it would appear, that the daily rate of mortality, in the first 12 hours, was 16 per cent.; in the next 12 hours, (12–24,) 37 per cent.; in the 2d day, 11 per cent.; in the 3d day, 8 per cent. The mortality of cases of cholera, in Paris, was 49 per cent. The force of mortality attained its maximum in cholera by the 21st hour, (18–24 hours;) the maximum intensity of smallpox being attained in days 10–15; of phthisis, in 6–9 months. The danger of cholera decreases as the time advances: the longer a cholera patient lives, the more likely is he to continue to live. Half the deaths happen in 24 hours.

The following table by Mr. W. Farr shows the probability of recovery from the severer attacks of cholera at the end of 12 hours, and of one, two, and three days:

	Cases.	To rec'r.	To die.	Probability of rec'y.		
0 hours,	10,000	5093	4907	·509	nearly	1 to 1
12	9185	5093	4088	·555	—	1·3 to 1
1 day,	7616	5093	2523	·669	—	2 to 1
2	6793	5093	1700	·750	—	3 to 1
3	6991	5093	1198	·809	—	4 to 1*]

6. Extent of Diffusion, and Causes.—On the first branch of this subject we cannot be wrong, so frequently have its details been presented to the public, in assuming considerable knowledge on the part of our readers; or in referring those who may wish for more minute information than is ordinarily possessed or than we have space to give, to the admirable chronological table of M. Moreau de Jonnés. The present epidemic originated in the district of Nuddea, and perhaps in some other parts of the Delta of the Ganges, about the end of May or the beginning of June, 1817. It did not during that year extend beyond the territory of Lower Bengal; but in 1818 and the early part of 1819 it diffused itself throughout the extreme length and breadth of the Indian peninsula, moving in lines more or less diverging, and attacking in succession places generally more remote from the seat of its origin, (though striking deviations from this rule were occasionally observed,) and situated in various directions from it; but leaving untouched many districts placed between its lines of movement. Its progress along the lines it selected was wonderfully uniform, being for some successive months at the rate of about one degree in a month. As early as 1818 it extended itself beyond the boundaries of Hindostan into the Burmese empire and other territories of Eastern Asia, and, making gradual progress through these extensive realms, reached China in 1820, and in the following year visited the numerous and populous islands situated in the Indian Archipelago. The Isle of France suffered its invasion in 1819, and some cases occurred in the same year at one point in Bourbon, in which island it has not since appeared. In 1821 it extended along the shores of the Persian Gulf, and during this and the following year spread through parts of Arabia, Persia, Mesopotamia, Syria, and Judea, and closely threatened Europe. It appeared in the Russian territories in 1823, at Saillon, Ghillan, Orenburg, and Astracan; but its further northern and western progress was for a time arrested. It, however, re-appeared in Orenburg in 1828, and again in 1829, and in 1830 advanced through the southern provinces of the Russian empire, till it reached Moscow on the 28th of September of that year. Its subsequent progress through Russia, Poland, the Austrian dominions, the north of Germany, and in England, is too familiarly known to render it needful that we should present its details to the reader.

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* [*Practice of Medicine*, i. 143.]

The space traversed as yet by this extraordinary epidemic may be conceived from the following simple calculation. The Philippine islands form (so far as is known) the eastern, and Mauritius the southern, boundary of the disease. The former lie in east longitude 125°, and the latter is in south latitude 20°. Archangel is the most northern, and the vicinity of Edinburgh the most western point to which it has extended. The former is in north latitude 64°, the latter in west longitude 3°. Hence it is manifest that the disease has passed over 128° of longitude and 84° of latitude.

[On the 26th of October, according to the above account, it first appeared in Sunderland; in January 1832, it was in Edinburgh; and on the 10th of February, in London. Its progress in every town in the British islands visited by it has been accurately traced by Professor Graves, of Dublin, (*Dublin Journal of Medical Science*, January, 1840; reprinted in the *American Medical Library*, vol. iii.: Philadelphia, 1840.) It is singular that there, as elsewhere, it left a number of places untouched, and others were but slightly affected.

Cholera first appeared in Paris in March, 1832, and, with great rapidity, various parts of France were attacked. From England the disease soon passed to Ireland, and appeared in Dublin in March, 1832. On the 8th of June, 1832, it was first seen on this side of the Atlantic in Quebec; and on the 10th it appeared at Montreal. On the 21st of June, it suddenly and unexpectedly appeared in New York,—all the intermediate cities on the seaboard of the provinces of New Brunswick and Nova Scotia, and of the States of Maine, Massachusetts, and Rhode Island, remaining wholly exempt. On Thursday, July 5, the first decided case manifested itself in Philadelphia. This city suffered much less than Montreal, Quebec, and New York. The disease spread in various directions, visiting Albany, Troy, New Brunswick, and Rochester, in July; Baltimore, Washington, and Boston, in August. During the same months, it was prevalent in several parts of New Jersey and Delaware. About the 1st of October it suddenly broke out at Cincinnati, and nearly simultaneously at Madison, Louisville, and St. Louis; and by the latter end of the month, it reached New Orleans. Leaving the Ohio, it visited Tennessee, Illinois, Indiana and Kentucky,—Lexington, Maysville, and some other towns, suffering severely. During the same year, the disease visited Campeche, where it was exceedingly fatal,—4000, out of a population of 20,000, falling victims to it. It also visited the Havana early in 1833, but never reached any other West India island; nor did it extend to Guiana, Demerara, or any of the embouchures of the great South American rivers, Amazon, Orinoco, or La Plata. In 1834, it revisited many of the cities of this country, which had previously suffered, and spread to others that had been left untouched; yet singular cases of entire immunity were met with. Two of these may be mentioned as examples: Fredericksburg on the Rappahannock, and on the great road from Washington to the South, may be said to have escaped almost wholly; and whilst the disease was prevailing at Richmond, and the inhabitants of Charlottesville, and of the University of Virginia, in its vicinity, were daily expecting a visitation, not a case occurred, although travellers daily arrived from the afflicted city in the public stage. Philadelphia and Baltimore both suffered again, but not severely, in 1834. Charleston also was visited, with most of the southern towns. The disease recurred, indeed, at intervals, for a year or two, but ultimately disappeared, not to return, unless the same endemico-epidemic influences should exist, which favoured its progression previously. In like manner it occurred at Marseilles and Toulon in 1835; at Naples in 1836; and at Bona in 1837. Marseilles was attacked, for the third time, in the same year, and it re-appeared in the autumn at Berlin, Prague, and Danzig. The number of persons attacked in the Lombardo-Venetian States, in 1836, was estimated at 100,000, of whom 55,000 died. In the latter part of 1837, the inhabitants of the British metropolis were alarmed by the appearance of cases at Limehouse, which were pronounced by some to be genuine Asiatic cholera; but, by others, to be emanations from "alarmist cholera-hunters." The disease, if it existed, never certainly became epidemic. (See the writer's *Practice of Medicine*, 2d edit. i. 132: Philad. 1844.)]

The questions naturally occur, what agent first generated the disease? and what has subsequently diffused it over so large a portion of the globe?

The first question must be answered by a simple statement of the facts, that it originated in the district mentioned after an unusual disturbance of the seasons with respect to alternations of heat and moisture; that it made its appearance at the commencement of a rainy season, so excessive that the Gangetic Delta was converted into a sheet of water; and that the very first point in which it was observed was the district of Nuddea, noted for the endemic prevalence of cholera, where the whole year had been rainy, and during every week of April and May (it began to manifest itself in the latter month) there had been a succession of thunder-storms. From this district it appeared to diffuse itself over the rest of Hindostan, its progress throughout the country being accompanied, as Mr. Orton informs us, by circumstances somewhat similar to those which attended its origin.

The second part of the question cannot be dismissed so lightly. As is well known, the doubt and difficulty regarding the subject exist chiefly with respect to the share which *contagion* has had in its diffusion; and this question we shall endeavour to discuss as succinctly, and certainly as dispassionately and fairly as possible. That our opinion, in the course of the investigation, has fluctuated, we feel it no discredit to avow. This fluctuation was either prior to the appearance of the disease in this country, or to our having it a sufficient length of time under observation to enable us to attain a settled conclusion; and when we show the conflicting nature of the evidence from which, under the circumstances mentioned, a conclusion was to be drawn, it will be manifest that fluctuation or total scepticism must have been its result. As this evidence consists of facts already before the public, we shall, for the sake of brevity, rather refer to than detail them, classing them, as nearly as their nature admits, according to the very precise rules laid down by Dr. Alison for discriminating the operation of contagion.

1. Strong evidence of a disease being contagious is furnished by its appearance in communities previously healthy shortly after the arrival of persons from infected districts, who are themselves suffering under the disease, or who sicken of it soon after their arrival. A striking example of this sort is related in the Madras Report of the appearance of the disease at Jaulnah, after the arrival of a detachment there from Nagpore, then infected, and its subsequent diffusion from the former place to the towns of Malligaum and Hydrabad, and various villages.

Other cases, though few so striking as this, might be selected from the Indian records, but we prefer referring to examples which occurred in the Russian epidemic. In the fortress of Razüpna, in that of Iletsk, and, towards the close of the epidemic, at Caramala-Gubeerra, all in the government of Orenburg, the invasion of the epidemic coincided, in point of time, with the arrival in them and sickening of persons coming from infected places. It should be remarked, however, that in these cases communication was not always traced between the individuals subsequently and those first attacked; and in the case at Razüpna, it is distinctly mentioned, that of the individuals who visited the man first seized on his arrival from Orenburg, then infected, not one took the disorder.*

Into the opposite scale, that of the non-contagionists, may be thrown facts which tend to prove that it has originated in districts previously healthy without any ascertained communication with infected persons, and that, on the other hand, the most ample intercourse has existed on various occasions between healthy and infected communities without the former having participated in the disease. Its introduction into the city of Orenburg in 1829 was not only not traced to communication from an infected district, but a conjecture that it might have been introduced either by the caravan which arrives from central Asia at midsummer, or by the Kirghis, a semi-barbarous Tartar horde, from whom the government of Orenburg is separated by the river Oural, was, if not disproved, rendered in the highest degree improbable.†

"When the disease attacked the sixth regiment at Colabath in July, 1828," says Mr. Assistant-Surgeon Spence, of the 52d regiment, "its commencement was a remarkable proof against its contagious nature. It was in the midst of the rainy season, and not a case had been seen for months either in or near Bombay, when Assistant-Surgeon Campbell, in paying his evening visit to the hospital, found an old soldier, who had been under treatment some time for hepatic affection, suddenly seized with cholera. He went to the opposite extremity of the building for the purpose of consulting with the surgeon, and found him busily employed with another man, who had been almost simultaneously affected. Now it is physically impossible that these two individuals could have received the disease by contagion, because that which does not exist cannot have issue." The disease proceeded with unabated violence till it destroyed sixty men and several women. (Taken from Mr. Spence's MS.; since published in the Medical Gazette.)

The following example of personal intercourse between the healthy and infected without communication of the disease, is taken from Mr. Annesley's Sketch of the Diseases of India. Cholera attacked the field force stationed at Shalligaum in Kandiesh, and raged with great violence among the corps posted on the left of the line, while the 17th battalion of native infantry, who were posted on the right of the line, were exempt from it, though they had constant communication with the other men.

2. The gradual diffusion of a disease through a limited community, those near the sick being first attacked, and others in succession in proportion to their proximity, is strong evidence of a disease being contagious. But this evidence has rarely been furnished by cholera; the general statement from India, indeed, is of a totally opposite nature; for we learn that, on its appearance in any place, numbers are simultaneously attacked, and that, after committing unheard-of ravages for a short period, its cessation is as sudden as its invasion. One example, however, resembling in some degree this gradual diffusion, is given in the Russian reports, and this is furnished by the staff-physician, Dr. Schimanski, with regard to the extension of the disease at Iletsk. He says he was able to trace the progress of the disease in the first eight cases, thus:—The husband of the woman, (a soldier's wife,) from Orenburg, was taken ill three days after her; and about the same time, also, two girls who lived in the immediate neighbourhood of the soldier, and who visited him soon after his arrival from Orenburg: the aunt of these girls, who nursed him, was next attacked; and from her it passed to her own two sons. (Edinburgh Medical and Surgical Journal, No. cviii. p. 130.)

3. There is no circumstance connected with the disease on which the information received from

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* On the Asiatic cholera as it appeared in Russia in the years 1829 and 1830, by *Dr. J. R. Lichtenstaedt.* (Translated in the Edinburgh Medical and Surgical Journal, No. cviii.)

† Ibid.

different quarters is more contradictory than the comparative liability to it of attendants on the sick and other members of the community. From India the testimony on this head is so conflicting that no conclusion can possibly be drawn from it: a state of complete scepticism is that in which it leaves the mind of an honest inquirer after truth. That from Russia is not of a much more decisive character; such as it is, we shall present it to the reader.

During two months, observes Professor Lichtenstadt, while the disease prevailed at Orenburg, and two hundred and ninety-nine patients were admitted with cholera into the military hospital, the personal attendants on the sick remained entirely exempt from the disease. They consisted of one hospital assistant, six pupils, as many Baschkir lads, and fourteen hospital servants, in all, twenty-seven; and their duties were to perform bloodlettings, apply leeches, poultices, and frictions, and administer baths and the like, so that they were compelled to be constantly breathing the exhalations from the bodies and clothes of the sick, as well as to touch and handle them. The washerwomen of the hospital likewise escaped; a class of individuals, who, it is well known, are extremely apt to suffer from contagious diseases.

On the other hand, Drs. Russell and Barry inform us, "that the number of medical men and hospital attendants attacked with cholera during the present epidemic, in proportion to the whole employed, and to the other classes of society, has been beyond all comparison greater here (St. Petersburgh) than in India under similar circumstances; twenty-five medical men have been already seized, and nine have died out of two hundred and sixty-four. Four others have died at Cronstadt, out of a very small number residing in that fortress at the time the disease broke out there. Six attendants have been taken ill at a small temporary hospital behind the Aboucoff." With regard to this last circumstance, it is not stated, as in another report by the same gentlemen (not published) bearing date 4–16 July, that "in the great Aboucoff hospital, where there were no cholera patients, but to which a temporary cholera hospital was attached behind the building, ten persons residing within the area of the establishment had been severely attacked up to the 12th instant (N. S.) with cholera." This leaves a very different impression, and not being aware of what is meant by "the area of the establishment," we cannot form an opinion how it may or may not bear towards the side of contagion. In the last-mentioned report, those gentlemen also state, that in the Military General Hospital, in which four hundred cholera patients had been admitted from distant quarters, up to the morning of the 13th, "one attendant had been attacked." But one attendant where so many cases had been treated!

These specimens, taken from an immense mass of foreign evidence, will suffice to show its conflicting nature on points essential to the decision of a much litigated and very important question. There are certain branches of the subject, such as the immunity apparently afforded by seclusion, which we have designedly omitted; partly because they were unavoidably exposed to sources of fallacy, and the testimony regarding them was of the same conflicting nature as the specimens which we have already presented to the reader; and partly that we might preserve space for an examination of the question, how far the general progress of the disease favours the opinion that human intercourse has been the instrument of its diffusion; and for the narration of certain facts illustrative of the general question which have fallen under our observation.

The progress of the disease on the great scale having been tolerably regular both geographically and chronologically,—that is, its having passed from country to country without leaving interjacent countries untouched, and those infected having been so in some proportion, in point of time, to their distance from its original source,—has been appealed to by two parties as evidence of the accuracy of their opinions; the one seeing in it a proof of a continuous stream of epidemic influence flowing from the point where the disease originated; the other a transport of the malady by human intercourse from the same source. To the opinion of a flow of epidemic influence, have been objected, and apparently with justice, the slowness of the progress of the disease; that it has extended its territory in spite of the opposition of continued and violent monsoons; and that, notwithstanding a degree of general regularity of progress, there have been anomalies observed in its course, such as its having left districts untouched whilst all around them were suffering, utterly irreconcileable with the opinion advanced. On the other hand, circumstances have been observed, which render it almost equally questionable whether contagion has been the sole instrument of its diffusion.

It has been asserted by the advocates of the exclusive operation of this principle, that the disease has always been found to move in the line of human intercourse, and it must be acknowledged that, whilst so migratory an animal as man inhabits the earth, it cannot well do otherwise; but if it is meant to be asserted that its diffusion has been in proportion to the intercourse between infected and healthy districts, the assertion is by no means supported by facts. Its appearance at Madras, for instance, whither according to this doctrine it ought to have been conveyed almost three months earlier by trading vessels from the infected districts, was simultaneous, as Mr. Bell informs us, with its origin in parallel latitudes in the interior. It did not reach Ceylon, to which, on the contagious principle, it ought to have been conveyed at a much earlier period, by shipping from infected points of the coast, until it had previously gained the nearest point to it on the continent, about Adam's Bridge, and had been long prevailing on both coasts of the peninsula. (*Orton* on Cholera, 2d edit. p. 332.) Unfrequented villages have been observed to suffer the invasion of the disease as early as the marts of intercourse and commerce; thus, from a statement of Mr. Orton, it seems to have reached some villages on the north bank of the Cavery,—detached from any frequented road, and considerably to the eastward of Trichinopoly,—quite as soon as this large and frequented town, whither it *appeared* to have been imported by a company of sepoys. (Ibid. p. 331.)

Its movement along *navigable* rivers has been dwelt upon as evidence that human intercourse has been the means of its diffusion; and it is an argument of some force in showing that such intercourse may have occasionally been instrumental in effecting it: but when we are informed by Mr. Orton that the disease manifested this predilection for the course of rivers in the peninsula of Hindostan, "where navigation is scarcely carried on, even to the most trifling extent, on any river, and scarcely an instance can be mentioned of a great road running on the bank of a river, for they almost all cross them," we must acknowledge that more weight has been attached to the argument than it is calculated to bear.

The disease, in its general course, has manifested a preference for one line of movement, and has rejected another, though there has been no striking difference in the amount of human intercourse between the two directions to explain the preference and rejection. Its progress in a north-western direction across the European continent has been briefly described, and is fully known to the reader. For three years it prevailed in the Ottoman territories bordering on the Levant; and it would appear, without any deficiency in the productive (or at least destructive) force of those germs of which we have recently heard so much; for in November, 1822, it numbered 4000 victims in eighteen days in Aleppo; yet it has not penetrated into Turkey in Europe, and other extensive realms on the shores of the Mediterranean. Assuredly this could not arise from want of means of transport, and few will be disposed to ascribe it to the perfection of the quarantine department of the Sublime Porte. Since its appearance in this country a similar predilection has been displayed; for we find it at this instant a hundred and forty miles to the north-west of Sunderland, whilst six miles south is the extreme distance to which it has reached in that direction; and from the point which it attained, Seaham Harbour, after attacking eight persons and destroying three, it has since vanished.

A circumstance which may be urged against the exclusive operation of contagion, (and it is against attributing too much to one principle alone that we are arguing,) is the unusual prevalence of disease, bearing a considerable relation to epidemic choleric fever, which generally occurs prior to the appearance of this in any given locality. The facts which might be mustered in proof of the antecedence of such disease are far too numerous and consistent to be accidental. Ordinary cholera, sporadic cases not distinguishable from the epidemic, excepting by the isolated manner in which they occur; epidemic diarrhœa; gastric and intestinal fever, have been observed in so many situations and by so many individuals, from 1817 to the present instant, to have been the precursors of the disease, that there cannot be a reasonable doubt of the accuracy of the observation. During the last year the prevalence of these affections in various parts of this country has been matter of familiar remark among medical men, and many of them have very properly taken care to record their observation. (See *Dr. Burne's* Dispensary Reports, in the Medical Gazette for July 2d, and July 16, 1831.). In this neighbourhood, what Mr. Orton felicitously terms the skirts of the approaching shower were manifest long before the epidemic made its formal inroad. Ordinary cholera was most unusually prevalent; whilst cases of disease, certainly not distinguishable by symptoms from the epidemic, occurred on the 5th, 8th, 14th, and 27th of August; and cholera continued to be very prevalent and severe throughout September. The cases which occurred in August were not matters of secrecy, but were the subject of conversation among the medical men of the place; and the writer frequently made the remark, that we were partakers of an inferior degree of the epidemic influence which existed on the continent. But certainly at the time he did not (nor does he yet) ascribe them to imported contagion; nor did he then conceive that we had, properly speaking, the epidemic among us. Whatever view others may now feel disposed to take of these cases, it would be difficult for them to suppose that the case we have mentioned, as having occurred in the interior in the beginning of July, was attributable to foreign importation.

Under either view, as it appears, whether we conceive that a current of contagion flows towards a district, or suppose the disease to be engendered there by indigenous causes, (not customary ones certainly, any more than those which existed in the Delta of the Ganges in 1817,) and then to be invested with some contagious property, which observation of the disease will induce most candid persons to admit it possesses, it requires the operation of two principles to explain all the facts of the case; for even on the first supposition we are compelled to imagine this double operation to be in progress,—a current of contagion to be flowing from one point, and a *nidus* for its reception to be preparing in another.

We have been led to the conclusion that the disease possesses a contagious property, from having observed that a considerable proportion of attacks have taken place in individuals shortly after communication with the sick, or exposure to emanations from the dead bodies, and, in part, from a few examples having occurred of the disease appearing in parts of the town or neighbourhood where it did not previously exist, on the sickening there of persons who had communicated with the infected districts; but at the same time we beg to remark that there are circumstances which tend to show that this property is abstractedly feeble in degree, and to render it more than questionable whether it can be the sole agent in diffusing the disease.

This opinion is founded on the singular anomalies observed in the course of the disease, and which still mark its progress, and on the following considerations:—

1. Members of that class of society which has manifested the strongest predisposition to the disease have been very long exposed to the emanations from the sick under circumstances the most favourable to the propagation of the disease, without being infected.

2. No death, and scarcely an attack of serious indisposition, has occurred among the medical men, though they have spent hours in the pe-

tients' chambers, assisting in frictions and other offices usually performed by nurses, and from the fatigue they were undergoing might be supposed to be peculiarly obnoxious to contagion.

3. Medical practitioners have not in any ascertained case conveyed the infection in their clothes to patients whom they were attending for other diseases, or to their families. Certain of them have mingled unreservedly with their own families after long attendance on cholera patients, without any indisposition, however slight, occurring in consequence. It is proper, however, to remark that two cases have occurred, one of them a fatal one, which might be attributed to the intercourse of medical men with their families.

4. When the disease has appeared in a private family in a situation in life above the labouring class, it has been confined, so far as the writer's knowledge extends, and he is of opinion that he is acquainted with the circumstances of all the cases of the kind which have occurred, to the individual first attacked, and has not in any instance spread to the other members of the family; nor have in these instances nurses or other casual attendants on the sick suffered, though belonging to a class more obnoxious to the disease.

5. The *agricultural* villages in the immediate neighbourhood of Sunderland, which had throughout the whole progress of the epidemic the most unreserved intercourse with us, remained and still remain exempt from the disease. The populous village of Deptford, situated near the river, at the distance of half a mile from Ayre's Quay, where the disease was very prevalent and fatal, and having the most constant communication with it, partakes of this exemption.* The town of South Shields, containing nearly 14,000 inhabitants, and distant from Sunderland but seven miles, remained exempt from the disease (with the exception of two cases, stated to be very slight, and not traceable to any communication with this place,) during the whole of its epidemic prevalence here, though calculations have shown that eleven hundred persons pass weekly between the two places. Explanations have been offered of this exemption; but they appear inadequate if we suppose this disease transmissible to every locality by human intercourse, since typhus, scarlatina, and other infectious diseases frequently prevail there to a great extent. Even to the present moment, (Feb. 2, 1832,) though its intercourse with Newcastle and other infected places has been incessant, but seven cases have occurred, and, as our intelligent correspondent there remarks, "We have not as yet got the disease as an epidemic, the cases have been so few and far between."

6. Though the disease has appeared, in certain cases, to be transferred to previously uninfected districts by spreading from persons who had sickened there after arriving from places where the disease prevailed, yet facts have occurred which tend to show that the sickening of such persons and the diffusion of the disease have, at least in some instances, been mere coincidences. A woman of the name of Liddle, who lived in Sunderland, sickened at the town of Houghton-le-Spring, six miles from this place, and died on the 5th of December. The next case occurred on the 8th of the same month, in the person of a female named Cockburn, who lived a considerable distance from the house where Liddle died, and in a different street, and had had no communication with her, direct or indirect; the family of the house in which the death occurred, and the persons who surrounded Liddle in her illnes, escaping all infection. In many other instances in which the disease has appeared in a mining district or village, (and it has spread extensively in such situations,) the first cases could not be traced to communication with infected places. In certain cases, however, and we shall mention that of Hetton, the persons first seized had been in communication with infected districts.

7. On the first appearance of the epidemic in certain places, several have been simultaneously attacked; at Earsden Colliery, for example, thirty-two. On its first breaking out here, it manifested itself in three distinct points, between which no communication could be discovered; and the attacks in two of these points were stimultaneous. It could not be traced from any source of infection to the individuals first attacked. In many instances, likewise, instead of residents in the same house being successively attacked, its invasion of several has been simultaneous.

8. There were feelings experienced by various persons, either otherwise in perfect health, or labouring under complaints distinct from the epidemic during its prevalence here, such as spasms, thrilling sensations of the extremities, and various affections of the nervous system, which appeared to betoken the influence of some cause more generally diffused than contagion; since many persons thus affected had not been exposed to any source of infection. The writer was at first disposed to attribute these occurrences to the influence of imagination; but they occurred in too many instances, and in persons too little sensitive and imaginative, to allow him to adhere to this explanation.

After assigning these reasons for questioning the exclusive operation of contagion, we think it right to remark that epidemic choleric fever has committed fearful ravages in some families, especially in those of which the circumstances were calculated at once to give intensity to the causes of the disease, and to render the individuals composing them more obnoxious to the action of such causes. Of one family seven were attacked with the disease, of whom five perished. The case of the first individual of the series constituted one of the sporadic cases, and it is incredible that the next in succession should have received infection from him, four months having elapsed between the dates of the respective attacks; but it is probable that contagion was transmitted from the second and subsequent cases, the diseases having commenced on the following successive dates, the 11th, 12th, 13th, 16th, 17th, and 20th of December. The case which occurred on the 20th was that of an infant, aged thirteen months, taken from the breast of the fifth patient in the order of succession.

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* There were two slight cases in this crowded village inhabited by the class most susceptible of the disease, but it did not spread from them to the rest of the population.

Many other examples of transmission through families have occurred, but few so striking as this. We are disposed to attribute to contagion its full share in the production of such cases, aided by the circumstances of night-watching, neglect of order and cleanliness, &c., which are accompaniments of sickness in the dwellings of the poor; but we must remark that cases have fallen under our observation and come to our knowledge, which show a proneness to the disease in certain families, independent of reception from a contagious source. The following is an example of this kind. A respectable female, living in the village of Jesmond Vale, where the disease did not exist, and who had had no intercourse with the sick, received a letter announcing that a sister, whom she had not visited during her illness, and who resided at Hartley a distance of nine miles, had died of the complaint. She sickened in an hour from the receipt of the intelligence, and died in thirteen hours from the commencement of the attack.*

The following propositions appear to be reasonable corollaries from the facts presented by this extensive and intricate subject.

1. Epidemic choleric fever originated in a certain district under peculiar atmospheric circumstances; but these circumstances having previously occurred in the same district without the production of a disease identically the same, we must regard its terrestrial or atmospheric cause unascertained.

2. On many subsequent occasions there have been marks of its commencement and gradual rise in other districts, which show that, in their soil or atmosphere, there has been a tendency to the production of the disease from causes equally unascertained as those which first originated it, and in such districts it has ultimately displayed itself.

3. It has thus appeared to arise in various districts not by any means always continuous with those previously contaminated, but often situated in some general direction with regard to them, declining in one district as it arises in another, and thus appearing to move in a succession of local epidemic visitations.

4. Within the district which it occupies it possesses a contagious property, or, in other words, those individuals who have intercourse with the sick, especially in a locally impure atmosphere, are attacked in a greater proportion than other members of the community; and it is probable that this same contagious property may be the means of diffusing it through a district disposed to the production of the disease, earlier than it might have arisen spontaneously there, or of exciting it in a district in which, notwithstanding a degree of predisposition, epidemic choleric fever might not have arisen spontaneously; but facts which we have mentioned tend to render it questionable whether it can be thus transferred to districts unpredisposed to receive or engender it.

5. Within the district where it prevails, ordinary endemial causes mingle their agency with that of the general cause of the disease, and the malady is found to vary in prevalence and intensity in different portions of the same district: thus the disorder is found to assail more individuals, and to be more destructive in parts which are dirty, and in those placed low or near the banks of a river, than in portions of the district differently situated. The effect of these endemial influences is illustrated by the progress of the disease in the town of Sunderland, and by the ravages it has committed in the village of Newburn. The latter place is built along the margin of the river Tyne, and between it and the river there intervenes only a bank, formed of a mixture of mud and sand, partially covered at high-water; whilst a shallow stream of water flows through the village. Here, although the disease has not ceased, three hundred and twenty persons have been attacked, and fifty-five have perished, out of a population of five hundred and fifty.

6. The character of the disease varies considerably in the different districts which it invades. Thus we had occasion to observe that in a mining population dispersed over an extensive tract of country, the township of Hetton, the disease was attended with less collapse than in the lanes and alleys of a populous commercial town, and the mortality was consequently much less; for we cannot too strongly repeat what we have already remarked, that the collapse is the measure of the danger. These observations are made with no view of depreciating the medical practice adopted in that district, which was extremely skilful and prompt, and even, with due allowance for the difference of the character of the disease, very successful. It should be remarked, moreover, that extremely collapsed were intermingled with the milder cases, but in proportions the very reverse of those we had observed elsewhere. In certain districts in Northumberland, we have reason to know the disease resembled, in its general character, that which prevailed at Hetton; but among some other mining communities the extremely collapsed has been the common form of disease. We have remarked, too, that whilst in some situations the cases have, almost without exception, commenced with diarrhœa, in others the proportion of instances in which this has constituted the initiatory symptom has been smaller.

This difference in the form of choleric fever in different local epidemic visitations, the cases occurring in any given district possessing a general correspondence in character, and being distinguished from those which occurred elsewhere, was observed in India by Mr. Scott; and it appears to us that this circumstance, coupled with the transmutation of the disease more and more into a febrile form as it has approached more northern climes, displays a deviation from that sameness of character observed in diseases engendered exclusively by human contagion.

It will hardly be expected that we should leave entirely untouched the question, whether the disease originated spontaneously in Sunderland, or was introduced from abroad; but the extent to which we have already pursued this intricate portion of our subject forbids our discussing it at any considerable length. Those who reason from the postulate that the disease is diffused only by human contagion will of course decide for importation; but others will very reasonably expect that before this be admitted, it should be proved by the same positive evidence that would be required to substantiate any other fact of importance. Any thing approaching to this, or even any considerable probability of such an occurrence, we have been unable to discover; and we cannot but agree with Dr. Ogden, that, whatever were the facilities for the importation of cholera here, they were much greater in other places; and that if it has been imported, so far from following the great routes of human intercourse, it has chosen one of the least frequented paths, (See Medical Gazette for January 21, 1832.) [See on all this subject the writer's *Practice of Medicine*, 2d edit. p. 138.]

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* Related to the writer by Mr. Greenhow, surgeon, of Newcastle, who attended the case.

The predisposing causes of the disease, and the means to be adopted for preventing its diffusion, have been published to the world in such multitudinous documents, that we consider it unnecessary to occupy our pages with remarks on subjects now so familiar.

[After the prevalence of cholera in England, Dr. Prout (*Bridgewater Treatise*, Amer. edit., p. 197: Philad. 1834,) observed an absence of the common lateritious sediments in the urine; and about the time the disease first made its appearance, he noticed a positive increase in the weight of the air, similar to what might be supposed to be produced by the diffusion of a heavy gaseous principle through the lower regions of the atmosphere. Hence he concluded, that the cause of cholera and of the urinary peculiarity was a poisonous body analogous to malaria, whose high specific gravity, and feeble diffusive powers, kept it near the earth's surface, along which it insensibly crept, especially in low and damp situations. He very properly, however, does not lay much stress on this conclusion. During the prevalence of the above-mentioned state of the urine, he likewise noticed, in almost every individual, an unusually acid state of the saliva, and of the cutaneous exhalations; and about the time the cholera prevailed, and a little afterwards, he saw more cases of oxalate of lime renal calculi, and of formidable hemorrhage from the kidneys, &c., than he had ever previously seen during the long period that urinary diseases had occupied his attention. As the cholera disappeared, these phenomena gradually subsided.

The epidemic at Naples was complicated by a verminous constitution of the most singular kind that has ever been recorded. This verminous epidemic was not, however, confined to those who died of cholera, or who were affected with symptoms of it, but occurred in all the inhabitants of the country; and it is asserted that the most constant morbid appearances, observed in cholera, such as injection of the digestive mucous membrane, development of the mucous follicles, the presence of an unusual kind of mucus, and of tricocephalous worms, with change in the character of the blood, were equally met with in those who died, during the epidemic, of other diseases than the cholera. (M. Thibault, cited in *Amer. Med. Intelligencer*, Feb. 15, 1838.)]

Treatment.—Previously to entering on this very important subject, we think it advisable to endeavour to correct the misconception which appears to prevail very generally among members of the profession, who have not as yet witnessed the disease, that some one specific remedy, or, at least, plan of treatment, must be sought for, and when discovered invariably adopted. The importance very properly attached by all writers to collapse as a feature of the malady, and their candid avowal of the difficulty they have encountered in combating it, is the explanation of the fact that medical men who are practically unacquainted with epidemic choleric fever, have taken a view of its treatment which in the case of almost any other disease they would have repudiated as unscientific. We know no condition more hopeless than that of extreme collapse in the disease:—so hopeless, indeed, is it, that often have we questioned, in watching a patient in this state, whether our art at present possesses or is likely to possess any resources against it, or, in seeing him emerge from it, and he has sometimes done so most unexpectedly, whether the remedies employed, or some hidden power of the constitution, had been instrumental in effecting re-action. But it should be remarked that only in a proportion of cases—a proportion varying, as we have already observed, in different localities, and in the same locality at different periods of the epidemic—does this extreme collapse occur; and that even in cases of which the natural tendency is to pass into this deplorable condition, much may be done by early treatment for its prevention. These considerations should teach physicians and patients that safety is to be found only in the early administration of remedies; and the former, when brought into contact with the disease, will soon discover that success in its treatment must result, as in the treatment of other fevers, from adapting his remedies to the varying circumstances of individual cases and of the different stages of the same case, rather than from the trial of specifics for one portion only of an extensive series of changes:—that his practice, in short, to be successful, must be rational, not empirical.

In the observations we have to make on the treatment, we shall follow the natural subdivisions adopted in describing the disease.

1. **Treatment of the Incipient Stage.**—We have adverted to two forms which this stage assumes. In the one, there is some general uneasiness, nausea, and vertigo: in the other these affections may coexist with diarrhœa, but the latter is frequently present without the former being discernible. The first of these forms, in which it may be remarked that medical aid is rarely requested, requires that the stomach should be unloaded by an emetic, and a table-spoonful of good mustard constitutes a very efficient one; a few ounces of blood should be drawn from a vein; a laxative of calomel and rhubarb administered; and the patient restricted to a diluent diet, and kept within doors and warm. The treatment of the diarrhœal form, to which circumstances witnessed by us lead us to attach considerable importance, must be noticed more at length.

It was mentioned that, in this diarrhœal form of the incipient stage, the evacuations are at first found to be fœcal and bilious; but at the time medical aid is summoned, they have generally assumed the serous character which they bear in the choleric stage. A state of the system resembling, in some degree, collapse, it was observed, coincided with this condition of the alvine discharges. In this state it was found very advantageous to give a dose of calomel, conjoined with a proportion of opium and some aromatic,* and in twelve or fourteen hours afterwards a dose of castor oil. On first visiting such a patient, a large blister was generally applied to the abdomen, in the cases under our care; warmth was enjoined,—indeed where compliance with our wishes could be enforced, the patient was confined to bed,—and it was directed that the diet should be diluent. The subsequent treatment consisted in the employment of smaller doses of calomel and opium for one or two successive nights, and a second dose of oleum ricini was sometimes administered.

In certain localities the writer has found the constitutional state accompanying this stage of the disease to be one of marked excitement rather than of feebleness and collapse, and some points of the abdomen have been painful on pressure. In such cases one general bleeding, or the very liberal application of leeches to the abdomen, has preceded the employment of other remedies. In other respects the same treatment has been found successful as that adopted in the preceding form, excepting that no stimulating ingredient was mixed with the calomel and opium.†

Under these plans of treatment we have the satisfaction to state that, in every case which has fallen under our immediate observation, the discharges have resumed their natural bilious appearance, and the diarrhœa has been finally arrested without the supervention of a cold stage, and, consequently, of fever, though the disease had occurred in various instances in persons who had been in incessant attendance on those ill of the feverish stage, and though in all cases it bore the characteristic marks of what we may term choleric diarrhœa. It should be remarked, however, that the choleric stage has supervened, as we have been informed, on diarrhœa which had been skilfully treated; but our inquiries have uniformly convinced us that in such cases medical aid had not been summoned till the diarrhœa had existed some time, and the subsequent stage was closely impending.

2. Treatment of the Cold or Choleric Stage.—In order that we may be distinctly understood in our observations on the mode of conducting this very important stage, it is necessary that we should adhere to its subdivision into two periods.‡

The first period is certainly that in which alone our most powerful means of arresting morbid actions can be employed with a considerable prospect of success. It may be considered an axiom in medicine, that fevers, to be successfully, must be early treated, and the rule has a powerful application to a fever so rapid in its course as that under consideration. But there are many obstacles to its being generally acted upon amid a town population; and one considerable obstacle, we apprehend, will every where be found in that self-deception which seems to be quite a feature of the disease. We have met with persons to whom, from their peculiar situation, all the symptoms of this fever were as familiarly known as to medical men, yet when they were attacked with it, they did not or would not recognise it; and one such individual actually walked out with the disease upon him, and failed to send for assistance till eight hours after its invasion, though it was so severe as to destroy him in twelve. So strong is this tendency to self-deception regarding the nature of the disease when the choleric stage actually occurs, that wherever choleric fever prevails, strong appeals should be made to the public on the necessity of early treatment of this stage, as well as of due care of that which generally precedes it.

The first remedy to be considered is *bloodletting*, and we shall endeavour to point out the circumstances which, so far as our observations extend, indicate, and those which forbid its employment. Its safe administration should be early, not according to mere time only, but with respect likewise to the rapidity of the disease, for one case will have made as considerable a progress towards actual collapse in two hours as another will have done in ten; and we should regard a considerable degree of collapse, indicated by feebleness or arrest of the circulation, and perceptible in the intervals of pain and spasm, (for when these occur, the pulse often sinks instantly, though only a second before it had been beating with considerable vigour,§) as an imperative reason for abstaining from drawing blood. But if we find the temperature not below or but little below the healthy standard, a pulse of tolerable force, and strong spasms recurring at short intervals, *provided collapse have not preceded this favourable condition*, we should at once open a vein, and not lose an opportunity, which will never be restored, of probably preventing extreme collapse, and either its immediate fatality, or its more remote but scarcely less fearful evils. But should this condition, with respect to circulation and temperature, have succeeded to collapse, either spontaneously or by the administration of remedies, our experience would dictate that bloodletting should be carefully abstained from, as we have seen great injury produced under such circumstances by its employment; cases having fallen under our notice in which the loss of three or four ounces of blood has destroyed the fruits of two or three hours' assiduous labour. The difference in the effect of bloodletting on conditions apparently very analogous, but differing in the periods from the commencement of the attack at which they manifest themselves, cannot be too strongly impressed on the reader's attention. Perhaps the only difference in external character which can be discovered between the two states will be the existence of spasms of considerable strength in the early period, whilst in that more advanced they have nearly, if not altogether, ceased; but in the one case bloodletting breaks the morbid catenations, and prevents collapse and congestion; in the other it lowers the vital energies which are freeing themselves from a state of oppression. But again, in a more advanced stage, when the constitution is no longer balancing between collapse and fever, and the latter may be considered as established, bleeding is a suitable remedy, if the state of the circulation and the general condition of the patient render it admissible. Thus, then, there are three periods of the disease at which, according to our experience, bloodletting may be employed: occasionally in the incipient stage, as has already been stated; in the early part of the first period of the cold stage; and at the commencement of the feverish stage, under circumstances to be subsequently mentioned.

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* The following is the formula we have usually employed.

R Hydrargyri chlorid. mit. gr. viii. vel. x.
Opii, gr. ii.
Pulveris capsici, gr. i ss.
Confectionis rosæ, q.ss. ut fiat bolus, statim sumendus.

† We think it proper to remark, as probably the reader will perceive the discrepancy, that this excited state of the system was not enumerated among the symptoms of the incipient stage of the disease in our description of epidemic choleric fever. In extenuation of this omission, and, perhaps, of certain deviations from strict order that may be discernible, it should be mentioned that the composition of this article and our acquaintance with the disease, in various localities, have been simultaneously in progress, and we have deemed it better to sacrifice some degree of regularity than to withhold from the reader information which may speedily prove valuable.

‡ The credit of this subdivision belongs originally to Mr. Kennedy. Experience in the disease having convinced us of its practical importance, we have adopted it in this article.

§ Query—Does this sudden and momentary arrest of the circulation arise from spasm of the heart?

We have been explicit on this head perhaps to prolixity, because we found great discrepancy in the testimony of various Indian and continental authorities regarding it; and in the early part of our experience of the disease, the selection of the appropriate time for bleeding, and the circumstances which indicated or forbade it, constituted the greatest difficulty we had to encounter.

The measure to be adopted next in succession to bloodletting will depend on the condition of the patient. If in a short time after bleeding we find a circulation of tolerable force, without much tendency to general or partial deficiency of heat, and if at the same time there be pain in the epigastrium increased on pressure, a very common accompaniment of cases in which the tendency to collapse is least conspicuous, a large blister or sinapism to the abdomen, and a dose of calomel and opium, in the proportion of from eight to twelve grains of the former to one and a-half or two of the latter, will be suitable remedies.— Should the circulation, on the other hand, be feeble, with general or partial deficiency of warmth, we should endeavour to rouse the system by full vomiting, and powdered mustard is a very proper means of accomplishing the object. Half an ounce of this substance, suspended in half an ordinary tumbler of warm water, may be considered a medium dose, and one which, in a great majority of instances, will act promptly and powerfully; but in a more advanced stage of the disease, when the collapse has been extreme, a whole ounce has been required to produce the full effect.* After full vomiting, sinapisms may be applied to the abdomen and along the spine; whilst the warmth of the patient is supported by bottles of hot water wrapped in flannel, bags of hot oats, and other familiar methods of applying dry heat, directed to the extremities or other points of which the temperature seems deficient. Frictions of the parts affected with spasm will at the same time be probably required, and should be performed under the bed-clothes. We have not found any beneficial effect, in relieving the spasms, from oil of turpentine or other stimulating embrocations; the coldness produced by their evaporation probably more than compensating for any benefit they are in other respects calculated to effect. A bolus of calomel, capsicum, and opium, the latter not in a proportion exceeding a grain and a-half or two grains, may be administered as soon as the vomiting from the mustard has totally ceased. The quality of the liquid given at this period ought to depend on the condition of the patient: if, for instance, the tendency to collapse be considerable, a little weak brandy and water should be given at short intervals; but, should the circulation be tolerably vigorous, and the temperature good, simple diluents, such as toast and water, constitute the most suitable beverage.

Should the patient be in a state of considerable collapse, whether consequent on neglect of the earlier stage, or occurring, which will occasionally prove to be the case, in spite of the most diligent attention to it, bloodletting should not form part of the remedial agents selected. If the temperature be in any considerable degree below the healthy standard, with the hands cooling rapidly on exposure to the air; the pulse at the wrist either very feeble or totally suspended; the breath and tongue cool; the surface shrunk and pallid, or in certain parts livid; the vomiting and spasms diminishing in their intensity, or totally ceased;— at whatever period from the commencement of the diseace this state of things may exist, bleeding should be abstained from. It will be advisable to endeavour to rouse the system by full vomiting; and half an ounce of mustard, or, if the attendant prefer another mode of accomplishing the object, two table-spoonfuls of common salt, a scruple of sulphate of zinc, or half a drachm of ipecacuanha with a small proportion of brandy may be administered. Should the emetic selected fail to produce its effect in a quarter of an hour, it ought to be repeated; or should the circumstances of the case lead the attendant to suppose that the sensibility of the stomach is very low, a larger dose of the emetic drug may be administered: we recollect having produced full vomiting by an ounce of mustard in a case of extreme collapse, in which two smaller doses had been administered successively without effect. Simultaneously with the exhibition of the emetic, dry heat should be applied by some of the methods already mentioned, or by that very convenient and simple apparatus, the hot air-bath.

Various internal medicines of the stimulating class have been recommended for this state. Those of which we have been led to form the most favourable opinion are mustard, carbonate of ammonia, and oil of turpentine. The first named substance we have not unfrequently administered in doses of a drachm, (a tea-spoonful unheaped,) at intervals of an hour or an hour and a half, apparently with the effect of giving additional vigour to the pulse, which had perhaps been restored by the vomiting; of producing bilious discharges from the bowels; of restoring the urinary secretion, and aiding the system in the transition into the febrile stage. If the carbonate of ammonia be the stimulant employed, a convenient mode of giving it is in doses of five grains every hour, with carbonate of magnesia, which makes it more easily retained should the stomach still retain its irritability. Should oleum terebinthinæ be selected, doses of two drachms may be given every second hour. Whatever stimulant medicine be employed, we should advise that calomel in doses of five or six grains, repeated at intervals of three or four hours, should be given at the same time, with the view of aiding the restoration of secretion; and, with the intention of at once rousing the system and lessening the irritability of the stomach, that a large sinapism should be applied to the abdomen, and another along the course of the spine.

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* It may save the reader some trouble to inform him, that an ordinary table-spoon, unheaped, contains half an ounce of mustard; and that the mustard sold in the shops under the name of Durham mustard, which is of a uniform bright yellow colour, is the most pungent and efficacious.

Various stimulating nostrums, if applicable to any, certainly only to this period of the fever, have been bruited forth to the world as specifics for the disease. In many of these we are of course inexperienced, and of all we are convinced the powers have been overrated, in some instances from partial and mistaken views of the malady, and in others from less pardonable reasons. It will not be deemed necessary that we should pass them all in review; but of certain remedies which have been proposed for collapse, the professional reader will require some notice.

The inhalation of oxygen gas has been suggested from many quarters; and in some cases in which it has been tried here an instantaneous amelioration has been manifest, the pulse having become more vigorous, the lips florid, and the patient having experienced relief from præcordial oppression and other distressful feelings, to an extent and with a promptitude not afforded by any other measure. But the experience of medical observers in general has led them to conclude that this effect is very transitory; and some are of opinion that they have witnessed an increase of the collapse after the temporary excitement, as if the vital power, instead of being permanently increased by the measure, had been expended in a momentary flash. Of some gentlemen, however, the opinion regarding it is more favourable. Our own opinion is, that inspired for a few seconds in single bladders, no great benefit is likely to accrue from it; but we should speak less positively of the effect of an atmosphere of diluted oxygen breathed for a considerable period.

The tobacco enema has been suggested by Mr. Baird of Newcastle, and, as he assures us, employed with considerable success. We acknowledge that *à priori* reasoning would rather have led us from this remedy than suggested it to us; but knowing the fallacy of such reasoning in medicine, we are not disposed to treat with neglect, still less with contempt, a measure of the beneficial effect of which a gentleman of talent and character adduces several examples. It was proposed after the disappearance of the epidemic from Sunderland, and we have no experience of it: but we would recommend that it should be tried in a case to the successful treatment of which other measures seemed inadequate, the practitioner being governed, as to its subsequent employment or rejection, by its effect.

Two remedies have also been mentioned to us by an individual of talent, and of great experience in the epidemic, Mr. John Fyfe, of Newcastle: we shall, with his permission, make the reader acquainted with them. One is the employment, in the period of extreme collapse, of an enema, consisting of two pints of warm water, from four to eight ounces of brandy, and from one drachm to two drachms of laudanum or Battley's sedative liquor. This, he assures us, has the happiest effect, in abridging that stage of the disease on the intensity and duration of which so much of the danger depends. The other is an enema containing a drachm of powdered mustard, which he has found to be very speedily instrumental in restoring the urinary secretion. This accords with our experience, as already stated, of the efficacy of this substance given by the mouth, in accomplishing the same object and the restoration of the secretions generally.

Weak brandy and water may be given occasionally during the collapse; and we have observed no injurious effect in this or any stage of the disease from the ordinary diluents taken in moderate quantities.

3. Treatment of the Excited or Febrile Stage.—The treatment to be now pursued will not require such lengthened discussion as that of the preceding stages, which may be considered as more exclusively belonging to this disease; for recognised principles, applicable to the treatment of pyrexia in general, must be our guides in conducting this fever.

The fever constituting this stage, be it in essence what it may, has inflammation accompanying it, of which the principal sites are the brain and the lining of the digestive canal, and to the subduing of these, by such measures as the state of the system admits, our attention should be carefully directed.

A form of fever has been described as supervening on an extreme and long-continued collapse in the cold stage, and in which fever it was mentioned that the vascular action was low and feeble, the temperature of the surface under the healthy standard, and the distribution of warmth very partial. In this low form of disease we have not ventured on general bloodletting; local bleeding from the temples has been freely performed, and occasionally too from the integuments of the abdomen, when there were any indications of inflammatory affection of the digestive canal; but the great degree of intellectual torpor and insensibility which attends these extreme cases renders the discovery of such an affection extremely difficult. Blistering the nape of the neck, and shaving the head so as to permit the application of cold, will be found very suitable measures. A degree of irritability of stomach, with occasional vomiting, is a very frequent accompaniment of such a case for the first two or three days; and under such circumstances leeches and subsequently a blister to the epigastrium have been resorted to with benefit.

Of internal remedies, that on which most reliance is to be placed is calomel, from its effects on the secretions, particularly of the intestinal canal, and from its facilitating the action of the laxatives which the state of the brain renders it advisable to administer. If two grains of calomel be given at intervals of three or four hours, an occasional gentle laxative, such as castor oil or calcined magnesia, will generally produce two or three bilious discharges from the bowels. Simultaneously with the administration of these remedies, the imperfect developement of heat and its partial distribution require attention. The patient should be placed near a stove or in some warm situation, and bottles of hot water, or hot flannels, should be applied to the feet, or other parts which are chilled. Even whilst endeavouring, by local depletion, to relieve partial determinations of blood, the general state of the system has been such as to require a little stimulus, and wine and water has been given, especially at an advanced stage of the disease, and occasionally medicinal stimulants, such as carbonate of ammonia, camphor, and sometimes, as a tonic, sulphate of quinine; but we cannot say that much benefit has resulted from the latter class of agents.

Such is the treatment we have generally adopted in that form of the febrile stage which is distinguishable from any fever we have been in the habit of observing here or elsewhere. The more excited form admits of one general bleeding with advantage, the amount of blood drawn being regulated by the degree of vascular action, of headach, of injection of the eyes, and various circumstances which would influence our proceeding in any ordinary fever. Should the head, as it generally does, continue affected after the blood-letting, the application of leeches and cold should be resorted to, the former being repeated, if necessary, to such extent and at such intervals, as the degree of headach, intellectual torpor, and vascular excitement may seem to require. Laxative medicine should be administered; and the purpose is exceedingly well answered by calomel in doses of four or five grains nightly, and six drachms or an ounce of castor oil every morning. The diet under such circumstances should consist of the mildest and simplest diluents, such as would be demanded in any case of inflammatory fever: after the case has subsisted some days, a little wine and water may be given if exhaustion be manifest, but it should not be continued beyond the necessities of the case. Though we have seen few or no cases without a degree of cerebral affection, examples are met with in which the disorder of the intestinal canal is more considerable than that of the brain. Diarrhœa, the discharges being deeply bilious; a red, glazed, and very dry tongue; some degree of fulness and tension of the abdomen, and of pain on pressure there; and scanty high-coloured urine, generally attend such cases. The general treatment of cases in which such an affection exists, must depend on the state of the system; but the intestinal disorder demands the free application of leeches to the parietes of the abdomen, repeated according to circumstances, and the internal exhibition of mild mercurials, such as hydrargyrum cum cretâ, or blue pill, with a small quantity of opium. That kind of permanent fomentation which is afforded by hot poultices to the abdomen, after the application of eeches, has been found beneficial. The diet hroughout a case in which this inflammation of he mucous lining of the intestines exists, should be mild and demulcent. In cases of this description—indeed in the most excited as well as in the lowest forms of the disease in which the collapse of the cold seems prolonged through the febrile stage—it is advisable to counteract, by warmth to the extremities and other points, that tendency to irregular distribution of blood which forms so striking a feature of the disease. Cases are occasionally met with, so mild in all their stages, that the fever requires no medical treatment but a few leeches to the head, a little laxative medicine, and abstemious diet for a few days.

[The intense thirst of cholera must be satisfied by a liberal allowance of ice or of ice-cold water. They are most grateful, and tend to allay the irritability of the stomach.

To arrest the diarrhœa in all stages, the acetate of lead was much employed in this country, and was highly extolled by many practitioners, as well as by Dr. Graves, of Dublin. In the writer's own observation it was not attended with any strikingly salutary effects. Strychnia was used endermically, and, it was affirmed, with advantage. It was, also, given internally to allay vomiting, and Dr. Ryan, somewhat hyperbolically we fear, states, that a twelfth of a grain, given in pill, and repeated a few times, has been frequently known to check a profuse diarrhœa with rice-water evacuations, and even when the extremities were blue, in cholera, (Ryan's *Universal Pharmacopœia*, 3d edit., p. 336: Lond. 1839.)

The extensive loss of serum, and, consequently, of the watery and saline parts of the blood, led to the administration of solutions of common salt and of the carbonate of soda internally, both by the mouth and in enema; but owing to the suspension of absorption, these substances rarely or never got into the blood-vessels. It was then proposed to inject them into the blood-vessels; yet although they became mixed with the blood, they could not remove the pathological cause that gave occasion to the profuse separation of its watery and saline portions. Hence, they were not found to answer preconceived expectations.]

Convalescence is in many cases tedious, the strength being slowly restored, and slight irregularities of diet sufficing to disorder the system, and even to produce relapse. For weeks after the fever we have found the patient still languid, and exceedingly prone to irregular distribution of blood, especially to undue determination to the head, inducing headach (requiring the application of leeches) on any considerable exertion. To prevent such occurrences, we have found it advisable that the diet should consist, in the early period of convalescence, of a moderate quantity of vegetable matter only, and that the transition to more abundant and substantial food should be very gradual; in short, that convalescence from this disease should be conducted in the same manner as that from other fevers.

We have stated that relapse may be produced by dietetic irregularities; and it is important to observe that even the best directed treatment of the incipient or diarrhœal stage may fail in its object, that of cutting short the disease, if such irregularities are indulged in. The relapses, properly so called, have occurred at an early period of convalescence; but we have witnessed one example, and that a very severe one, of the recurrence of epidemic choleric fever after an interval of two months from the preceding attack. This we were disposed to consider rather as an example of second invasion than one of relapse, though it is proper to remark that the patient had remained feeble from the period of the previous disease. No assignable cause existed for the second attack.

[During the prevalence of cholera, municipal regulations were made in many of the cities in regard to the articles of diet that might be allowed with safety, during the epidemic constitution.—Some of these were of the most whimsical kind, dependent probably, at times, on individual likes or dislikes, caprices or prejudices. Ripe fruits, and succulent vegetables, were generally proscribed: yet the fact, that in charitable institutions, where no such articles were permitted, cholera was most fatal; that the disease prevailed most fatally at Moscow, St. Petersburg and elsewhere, at seasons when ripe fruits and vegetables could not be procured; and that where ripe fruits were freely allowed, as in London, at a later period of the epidemic, no inconvenience was found to result from them, ought to have created well-founded doubts, whether the proscription were founded on accurate observation. (See the writer's *Elements of Hygiène*, p. 302: Philad. 1835; and his *Practice of Medicine*, edit. cit. i. 147.)]

JOSEPH BROWN.

[III. CHOLERA INFANTUM.—This form of cholera, commonly known under the name of *summer complaint*, has been generally regarded as peculiar to the United States. As elsewhere remarked, however, (*Practice of Medicine*, edit. cit. i. 147,) it strikingly resembles the affection vulgarly called "*watery gripes*," in England. It does not appear to be known in Paris: (Barthez and Rilliet, *Traité Clinique et Pratique des Maladies des Enfants*, i. 552: Paris, 1843.) It is one of the most fatal affections to which children are liable. In Philadelphia, during a period of fifteen years, from 1825 to 1839 inclusive, 3352 infants died of it—being almost 10 per cent. of the whole number of infants under five years of age who died during that period; and 4·5 per cent. of the entire mortality of the city. (Condie, *Practical Treatise on the Diseases of Children*, p. 217: Philad. 1844.)

Diagnosis.—Cholera infantum commonly begins with diarrhœa, more or less profuse; but at other times both vomiting and purging come on at first, without any premonitions; or the infant may have suffered for a time under gastric or intestinal derangement. The pulse is usually frequent and somewhat tense; and there are almost always manifest signs of febrile irritation. The discharges are, at first, extremely fluid and often frothy, sometimes tinging the cloths green, and at others leaving mucus upon them. In very severe cases the system becomes rapidly prostrated, and the child may die in the course of twenty-four hours; but more commonly the disease continues for a few days before either the tendency to convalescence or to death is manifest. As in the cholera morbus of the adult, there is often severe intestinal pain, which may be increased by pressure; and, at times, the muscles of the abdomen and extremities contract spasmodically. The thirst is excessive, and the appetite gone or singularly capricious. If the disease be about to terminate unfavourably, emaciation makes frightful progress; the febrile irritation is constant and manifest; the child becomes restless and comatose, and gradually sinks—the fatal termination being, at times, preceded by convulsions. Frequently, the evacuations exhibit the existence of great irritability of the digestive tube, the food passing rapidly through it without undergoing any change, and being squirted out with great force. At other times, they have a putrid or cadaverous odour. In the more protracted cases, these appearances are more frequently met with, along with aphthæ of the mouth, meteorism of the abdomen, and other signs of follicular inflammation. At times, before death, a vesicular eruption appears extensively on the chest, which Dr. Dewees (*Treatise on the Physical and Medical Treatment of Children*,) considered to be invariably a fatal symptom; but Dr. Condie (*op. cit.* p. 219,) states, that he has in many instances known the patient to recover even when this eruption has been the most extensive and distinct.

The great indication of recovery is the appearance of feculent matter, and of the ordinary secretions in the evacuations.

Causes.—Excessive heat is unquestionably concerned in the causation. It is, indeed, in the summer months that the disease prevails so fearfully and so fatally in our cities; yet something more than heat is required to induce it extensively; for, in country situations, it is comparatively rare. Atmospheric vitiation must be combined with atmospheric heat, and hence it prevails in the most crowded alleys of cities. In cleanly and well-ventilated districts, and in large, airy apartments, deaths from it are uncommon; so that at times when the bills of mortality indicate the greatest amount of deaths, physicians who practise extensively in the better portions of cities may see but little of it. (*Practice of Medicine*, i. 148.) Dr. Condie (*op. cit.* p. 221,) states, that when it occurs in the country, it is almost exclusively in low, damp, and otherwise unhealthy situations; but such has not been the result of the author's experience. Age affords a predisposition. The common idea is, that children are more liable to it in the second summer than in the first; but this does not seem to be confirmed by statistical observations. From the official reports of deaths in Philadelphia and New York, it would appear that, in the former city, of 229 deaths assigned to summer complaint, 142 occurred in children under one year of age; 75 in those from one to two years; and 12 in those from two to five years. It rarely occurs in infants under three months of age.

Under the predisposition induced by great atmospheric heat and vitiation, it is clear that improper aliment may be an exciting cause; hence, children brought up on spoon-meat suffer in greater numbers than those that are nourished at the breast.

In like manner, dentition may contribute to its production.

Pathological Characters.—The mucous membrane of the bowels generally exhibits evidences of inflammation, especially of the follicles, which by some have been regarded as the primary seat of the disease. When it has existed for any time, increased redness, in points and patches, has been observed in different parts of the stomach and intestines; but attention has not generally been paid to distinguish whether these consist in simple hyperæmia or in inflammation of the lining membrane. The follicles are very generally enlarged, inflamed, and occasionally ulcerated; the enlargement, according to Dr. Horner, (*Pathological Anatomy*, Philad. 1829,) often resembling a sprinkling of white sand upon the surface of the mucous membrane. Occasionally, considerable portions of the digestive tube are so much contracted as scarcely to admit a small-sized quill; at other times, portions of the mucous membrane of the stomach and intestines are greatly softened. The liver is almost always enlarged. This has likewise been regarded as the primary affection; but it is more probably secondary. The encephalon, in nearly all cases, has been found in a state of hyperæmia, and in long protracted cases serous effusions have been met with in the ventricles, and at the surface of that viscus.

Treatment.—The general principles of management do not differ materially from those laid down under enteritis of the mucous coat, and diarrhœa. The cases that occur in the airy parts of a town are usually managed with facility, and carried to a fortunate issue; whilst those in the narrow alleys of the worst parts too often resist every effort of the practitioner. It is all-important to remove the little sufferer from the air that has generated the disease, to another situation. This of itself is often enough to arrest the affection; but it may be necessary to combine with it a gentle laxative — as a small dose of calomel or of rhubarb and magnesia. Should the febrile action be considerable, it may be advisable to apply a few leeches to the epigastrium, more on account of the revulsion, than of benefit to be derived from loss of blood,—covering the abdomen after the leech-bites have ceased to bleed, with an emollient poultice. In other cases, especially where there is great irritability of stomach, stimulating cataplasms or fomentations may be applied, and in protracted cases a blister. Should the disease not yield to the above treatment, small doses of the mild chloride of mercury may be given frequently, to produce a new action, if the child be under two years of age, which, as has been seen, is usually the case. After this age, there is greater danger of inducing severe mercurial stomatitis.—Should signs of acidity exist, magnesia in the early period, and prepared chalk subsequently, may be useful adjuncts. Hence, the hydrargyrum cum cretâ of the pharmacopœias is a convenient preparation. Where irritability of the stomach is present, which is not relieved by external revellents, injections of salt and water may be used in the way of revulsion; or gentle excitants may be given internally, as a drop or two of oil of aniseed in sugared water, or five or six drops of sulphuric ether in the same vehicle.

It need scarcely be said, that should irritation from teething exist, the gums should be freely divided, and should even the tooth not be set at liberty, the revulsion, thus induced, may prove salutary. The warm bath is beneficial in all periods of the disease. In the more protracted cases, astringents become necessary. The acetate of lead has been highly extolled by many. (Dr. H. Lindsly, *Amer. Journ. of the Med. Sciences*, xxiv. 311.) The oil of turpentine has been advised when there is flatulent distension of the stomach and bowels; and with the same view, a few drops of any of the essential oils may be administered. Great caution must, however, be had in the use of both excitants and astringents. During the convalescence any of the milder tonic infusions may be prescribed.

Throughout the disease, care must be taken in regard to the diet; and, where practicable, the child should be mainly restricted to the mother's milk. Where this cannot be done, boiled milk and water, with any of the farinaceous preparations, as sago or arrowroot, may be used. By many, the infusion of benne-leaves or gum-water is given freely; but it may be questioned whether these mucilaginous substances are of much benefit;—they may tend to shield and soothe the part with which they come in contact, but they are difficult of digestion. The appetite is apt to be very capricious—a great desire being occasionally shown for salted meat, salt fish, butter, &c.; and it has been esteemed proper to gratify it occasionally to a certain extent. Doubtless, in many cases, no evil has resulted from such indulgence, but it must necessarily be hazardous. To allay the intense thirst, iced water may be allowed; or the infant may be permitted to suck ice contained in a piece of gauze.

At all periods of the disease, one of the most important curative agencies is change of air. If the child be removed into the country, this is the best course; but where this cannot be accomplished, riding or carrying the child about in the open air is of essential service.

In the way of prevention, removal during the summer heats to the country; or, if compelled to remain in town, sleeping on a mattress, with the door and windows of the chamber open; the daily use of the tepid or cold bath; exercise in the open air, and, if the child be weaned, well-regulated diet, with especial abstinence from unripe fruits and the succulent vegetable. The constant use of a flannel bandage, even through the heat of summer, has appeared to the writer an important prophylactic.

ROBLEY DUNGLISON.]

CHOREA.—The word *chorea*, as used by the ancients, signified a dance of many people to music, being derived from χορὸς, a band of singers and dancers. The origin of its application to nosology is involved in some obscurity. Sydenham and other writers have treated of the disease under the name of *chorea Sancti Viti*, a designation which has been very properly curtailed by Cullen and most subsequent authors. This latter appellation, we are told by Horstius, was acquired in consequence of some women of disordered minds and affected with a peculiar restlessness of their bodies, repairing, once a year, to the chapel of St. Vitus, near Ulm, and continuing there, night and day, leaping and dancing, until they were completely exhausted. By this means they were said to be cured for a time; but at the expiration of a year the disease returned, and was again removed in the same manner. The malady, worms, from accumulated fæces, improper diet, &c. But it has also been occasioned by affections of the mind, such as fright.* Dr. Reeves states that in the majority of cases the disease is attributed by the parents to this cause, (Edin. Med. and Surg. Journ. vol. viii. p. 315); and Mr. Bedingfield tells us, that of upwards of forty cases which occurred at the Bristol Infirmary, by far the greater number were induced by fright. (Compend. of Medical Practice, p. 52. London, 1816). It has also sometimes arisen from irritation.† It has been occasioned by a wound of the brain through the orbit, (Philosoph. Transact. vol. liii. 1763), and other injuries about the head. (Edin. Med. and Surg. Journ. vol. viii. p. 406; vol. ix. p. 123. Med. and Phys. Journ. vol. xv. p. 127). A case, in which it was induced in a man twenty-three years of age by injury to the scapula, is related in the Medico-Chirurgical Review. (Vol. ii. p. 569. 1827). It has also been occasioned by teething, (Edin. Med. and Surg. Journ. vol. i. p. 32); by the deleterious influence of certain metals and their compounds; preparations of lead, for example, or of mercury, (*De Haen*, Rat. Med. part iii. p. 202. New York Med. and Surg. Register. 1818. Med. and Phys. Journ. vol. xlii. p. 160); by suppressing eruptions of the skin, (Darwin's Zoonomia, vol. iv. p. 290. *Wendt*, Nachricht von dem Krankeninstitut zu Erlangen. 1783); and frequently by retarded or difficult menstruation. (Bedingfield's Compendium, &c. p. 52).

[Age occasions a marked predisposition. The disease is one of childhood. Of 32,976 children, admitted into the Hôpital des Enfans of Paris, during 10 years, only 189, according to M. Rufz, (*Archives Générales de Médecine*, iv. 239: Paris, 1834), were affected with chorea; so that it is not very common. In the composition of their chapter on this subject, MM. Barthez and Rilliet, (*Traité Clinique et Pratique des Maladies des Enfans*, ii. 294: Paris, 1843), state that they had analyzed only nineteen cases, and some of these were communicated to them by other observers. In a recent clinical lecture on chorea, (*Medical Examiner*, Jan. 27, 1844), the writer stated that he had not seen, altogether, more perhaps than thirty well-marked cases. The ages, at which the disease prevails most, are from 6 to 14.

Sex, also, affords a predisposition, according to all observers. Of 240 cases, recorded by M. Dufossé, 79 were in boys, 161 in girls, (H. Bell, Art. *Chorée*, in Dict. des Études Médicales, Paris, 1839); and of the 189 cases referred to above, 51 were males, and 138 females. From the cases that have been recorded by different practitioners, it has been calculated, that the proportion of females to males is nearly 3 to 1. (*Practice of Medicine*, 2d edit., ii. 240: Philad. 1844.)

In regard to constitution, great difference of sentiment has existed. Some—as the Franks—affirm, that it occurs chiefly in the scrofulous and the rickety; while others, as Dr. Elliotson, (*Principles and Practice of Med.*, Amer. edit. by Dr. Stewardson, p. 624: Philad. 1844), M. Rufz, and MM. Barthez and Rilliet, state, that no constitutional difference is perceptible between those who are affected with chorea and those who are not. A like discrepancy exists in regard to the colour of the hair. MM. H. Bell, Rufz and Dufossé say that the subjects are chiefly light-haired: whilst Dr. Watson (*Lectures on the Principles and Practice of Physic*, Amer. edit. p. 360: Philad. 1844) remarks, that the disease occurs much more frequently in children having dark hair and eyes. It would appear, also, that a predisposition to chorea may be transmitted from parent to child. (Elliotson, *op. cit.*)

The disease may unquestionably be developed by imitation, and hence the necessity in boarding-schools of keeping the patients separated. (Andral, *Pathologie interne.*) It is proper, however, to remark, that M. Blache states, that in the large Hôpital des Enfans, of Paris, he never saw it produced in this manner.

Dr. Bright has drawn attention to the connection of chorea, in certain cases, with affections of the heart and pericardium; and Dr. Addison has noticed mitral *bruit* or other signs of morbid action of the mitral valves to be pretty uniformly present in chorea,—which he is rather inclined to consider an effect of the disease than a cause. (The author's *Practice of Medicine*, ii. 241.)]

It is extremely probable that the convulsive motions may be continued, merely from habit, a considerable time after the original cause is removed.‡ Mr. Hunter, of Glasgow, conceives that, although the motions are not at first dependent on any derangement of the brain or spinal cord, yet the irritation, which acts at first locally on the nerves of the affected muscles, may spread till it affect the root of the nervous system itself; and in this way he would explain the continuance of the convulsive motions after the removal of the original cause, (Edin. Med. and Surg. Journ. vol. xxiii. p. 270.) May the morbid appearances, such as the following, which have been observed in some cases of chorea after death, be accounted for in this manner?

In two instances Dr. Willan found some ounces of serum in the ventricles of the brain, (Reports on the Diseases of London, p. 245.) Dr. Coxe, of Philadelphia, who conceives that chorea uniformly arises either from hydrocephalus or its forerunner, inflammation and turgescence of the blood-vessels, found, in a fatal case, the vessels turgid, and twelve ounces of serum in the ventricles, (Med. and Phys. Journ. vol. xiii. p. 406; vol. xviii. p. 221.) Dr. Patterson, of Londonderry, (who, in opposition to Dr. Coxe's Views, and in accordance with Dr. Percival, of Manchester,—see Medical Tracts, vol. i. p. 125, 1791,—considers that in chorea, as in other convulsive diseases, hydrocephalus is for the most part rather a result than the cause,§) has related a case in which he found the blood-vessels turgid, and traces of inflammation in the brain, a kind of serous diffusion over the convolutions, and three ounces of serum in the ventricles.* He also mentions a case in which the patient, after being cured of chorea, very soon fell a victim to hydrocephalus, (Med. and Phys. Journ. vol. xv. p. 127.) M. Serres states that in one case he found a fatty tumour resting on the tubercula quadrigemina; in another, marks of considerable excitement, with bloody effusion at the base of these bodies; and in two others the whole of their substance was inflamed, and the inflammation extended to the roof of the fourth ventricle, (Lancet, vol. xiii. p. 133.) It appears also that he has, by experiments on living animals, found that injury of these parts is followed by motions similar to those of chorea. We are not aware that these experiments have been published in detail, and are therefore unable to estimate their accuracy or conclusiveness. We would, however, express a doubt whether M. Serres's cases of chorea were of the ordinary species; and we think that the simple fact of their proving fatal, in some measure justifies us in this hesitation, especially when the vagueness with which the term has been often used is taken into consideration. We shall presently remark on the probable origin of those more rare diseases which have been denominated chorea. In the mean time, we shall only mention that M. Serres admits that he has seen cases of chorea in which no injury in the brain could be discovered after death. In a fatal case of a somewhat anomolous character, published by Dr. Hawkins, there was no morbid appearance discovered within the cranium, but earthy concretions were found in the pancreas, omentum, and mesentery; tubercles in the lungs; and the uterus was large and vascular, with its lining membrane highly injected, (Med and Phys. Journ. vol. lvii. p. 240.)

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* *Stoll*, Rat. Med. part iii. p. 405. Edin. Med. and Surg. Journ. vol. ix. p. 382. Med. and Phys. Journ. vol. lii. p. 262. Med. Chir. Transact. vol. x. p. 225. Med. Gazette, vol. i. p. 195. Manson's Medical Researches, p. 196.

† Edin. Med. and Surg. Journ. vol. i. p. 31; vol. iii. p. 441; vol. xii. p. 491. See also *Haygarth* on Imagination as a Cause, and as a Cure of Disorders of the Body. 8vo. Bath, 1800.

‡ "Sæpe tamen malum consuetudine ingravescens levioribus causis excitatur, parum cognitis, neque facile observandis." *Gregory*, Conspectus Medicin. Theoret. vol. i. p. 212.

§ This question is ably argued between Drs. Coxe and Patterson, in the 13th, 15th, and 18th vols. of the Med. and Phys. Journal.

[The fact, that the disease generally terminates in perfect health, shows that the affection of the neurine is not serious, and classes the disease amongst the neuroses. They who believe that the cerebellum is the regulator of the movements would necessarily place chorea in that part of the encephalon. Dr. Marshall Hall refers it, with convulsive movements in general, to his reflex system;—in other words, to the true spinal marrow. The disease belongs, however, rather to a badly regulated volition, like that which exists in stammering, which has, indeed, been called —not inappropriately—a "Saint Vitus's dance of the voice," and is, consequenty, encephalic rather than spinal. The disease is essentally a functional affection of the nervous centres, in the large majority of cases, but of what precise nature we know not,—except that, generally, signs of great nervous mobility and debility are present, and have to be energetically combated.]

Treatment.—If proof were wanting of the varied origin of chorea, it might perhaps be found in the numerous and sometimes conflicting remedies, which have from time to time been extolled as successful in its treatment. From this circumstance, indeed, it has been concluded by some that the disease in general subsides spontaneously, and is but little under the control of medicine; a belief which receives some degree of countenance from the general tediousness of the complaint, under any mode of treatment. It is, doubtless, quite as difficult in this disease as in many others to distinguish between mere *sequence* and *consequence*. As we have, however, a perfect conviction of the efficacy of certain remedies, almost opposite in their nature to others which have been sanctioned by high authority, we must either admit a difference in the exciting causes, or explain the seeming inconsistency by supposing that one remedy cures the disease by removing the apparent cause, and another by correcting some state of the system which may either render it susceptible of its influence, or be itself an immediate and essential link between that cause and the symptoms of the disorder: for example, that of the two most approved methods of treatment in the present day, purgative medicines may be beneficial by removing causes of irritation from the intestinal canal; while metallic tonics may cure the malady by correcting a weak, mobile, or irritable state of the body, without which such irritating causes would not have produced the disease, and in consequence of which, indeed, it may often be prolonged after such causes are removed.

Since the publication of Dr. Hamilton's work, "On the Utility of Purgative Medicines," the administration of cathartics has almost uniformly entered into, if it has not constituted, the sole treatment in chorea. Though it formed perhaps, the principal part of Sydenham's practice in this disease, it had become in a great measure discontinued; and Dr. Hamilton undoubtedly produced by his treatise a most important and useful change in this respect; and proved, in a vast many cases, not only the safety, but the extraordinary efficacy of very powerful cathartics. When the disease is yet in an early stage and scarcely established, gentle aperients may be sufficient, or indeed all that it is proper to administer. But he tells us that in the confirmed stage, when the intestines have in a great degree lost their sensibility, and the accumulation of fæces is great, whoever undertakes the cure of chorea by purgatives, must be decided and firm to his purpose. Powerful medicines must be given, in successive doses, in such manner that the latter doses may support the effect of the former, till the expulsion of the accumulated matter is completely effected. When worms are known to have been passed by the bowels, or are suspected to be the cause of the complaint, the most successful, if not a specific remedy, is the oil of turpentine, in a full dose of from three to six drachms, or more, according to the age of the patient and other circumstances.

[The oil of turpentine is a valuable remedy in chorea, whether produced by worms or not. When the bowels have been torpid, and the girl is of an age at which the first occurrence of menstruation may be looked forward to, its advent has appeared to have been hastened, and great relief to be produced by turpentine.]

Although purgatives, however, are in many cases the most efficacious remedies, and perhaps necessary in the greater number, both in commencing the treatment, and at intervals afterwards, we believe most practitioners will admit that they have often failed in removing the disease, and that medicines of another kind have succeeded without their assistance; while Cullen and other high authorities state that they have found repeated evacuations, of any kind, in many cases injurious.

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* Med. and Phys. Journ. vol. xv. p. 119, et seq.; vol. xviii. p. 234; or "Letters concerning the Internal Dropsy of the Brain." 1794.

In most instances, more especially after the exhibition of purgatives, we conceive that of all remedies tonics are the most successful. Sydenham used only the vegetable tonics; and Cullen preferred cinchona to the metallic preparations, as being of safer administration. We think there is no doubt, however, that the latter possess considerably more efficacy, and many of them are now found to be perfectly safe, in infinitely larger doses than were formerly considered prudent. The preparations of iron, zinc, copper, silver, and arsenic, are those which have principally been exhibited.

Dr. Elliotson has contributed much to establish the efficacy of the subcarbonate of iron in chorea. In the thirteenth volume of the Medico-Chirurgical Transactions, he published an account of eight cases cured by it, and proved that it might, and required to be given in much larger doses than had before been usual. Even the presence of headach, giddiness, and symptoms of paralysis, do not always, he says, forbid its use, but frequently disappear under its exhibition. In four of these cases no purgatives were administered, and in some of the others they could have aided but little in the cure. In his lectures, published in the Medical Gazette, he tells us that he has since cured many dozen cases by the same medicine, and has scarcely failed in a single instance; and adds that he thinks it will prove effectual in more cases than any other remedy. Occasionally it has been necessary to continue it for three months. (Medical Gazette, vol. viii. p. 653.) The dose of the medicine may at first be from half a drachm to a drachm, increased by degrees to three or four drachms, and taken every six hours, in gruel, mucilage, or treacle; which latter may obviate any constipating effect from it. The sulphate of iron has also been found of some efficacy in chorea, and may be administered in doses of from one to four grains.

[The ferro-cyanuret of iron has been administered with success,—three grains being given in the form of pill three times a day.]

The sulphate of zinc has great power over the disease, and may be given in considerable doses, when they are increased in a gradual manner. The oxyd of that metal, however, is a more manageable preparation, and we have found it of the most uniform efficacy. It may at first be given in doses of five grains, and gradually increased. We have given it, in one case, in doses of twenty-five grains. Mr. Bedingfield states that this remedy was so speedily and decidedly successful in the Bristol Infirmary, that he cannot help regarding it as a specific. Upwards of forty cases, occurring there, were, with one exception, cured by it; and he attributes its failure in other hands to its not having been administered with sufficient regularity, or in sufficient doses to excite nausea. Some of the cases, however, were cured without the nauseating effect. (Compendium of Medical Practice, p. 51.) [The cyanuret of zinc has likewise been efficacious.]

The preparations of copper having been sometimes efficacious in other convulsive diseases, such as epilepsy and hysteria, have been given in chorea. The sulphate may be administered in doses of a quarter of a grain, or half a grain, twice a day, and the quantity increased if the stomach will bear it. The ammoniuret, or the cuprum ammoniatum, introduced into practice by Cullen, is of safer exhibition, though it should also be begun in very small doses. Cullen states that he had in some cases increased the dose by degrees to five grains and upwards, and that he had often found it to cure epilepsy. In chorea its virtues do not appear to have been by any means so striking as those of iron and zinc. Dr. Uwins relates a case which got well under its use, combined with digitalis and myrrh. (Edin. Med. and Surg. Journ. vol. viii. p. 408.)

The nitrate of silver, likewise a successful remedy in epilepsy, has been occasionally administered in chorea. In our own practice it has almost uniformly disappointed our expectations. By others, however, it has sometimes been found successful, as in a case related by Dr. Uwins, in the Edinburgh Medical and Surgical Journal, (vol. viii. p. 407;) in two, by M. Price, in the Medical and Physical Journal, (vol. lii. p. 263;) in another, by Mr. Franklin, in the same work, (vol. xxxiii. p. 273;) and in another, by Dr. Crampton, in the Transactions of the King and Queen's College of Physicians, (vol. iv. p. 114.)

The liquor arsenicalis has been used as a tonic, in this as in some other diseases, with considerable success. Several cases of its efficacy are published in the fourth, tenth, and eleventh volumes of the Medico-Chirurgical Transactions. In two of these arsenic was the only remedy used, (vol. x. pp. 227, 229;) in the others it had been preceded by purgatives. The dose of the solution should at first be three drops thrice a day, and it may be increased to ten drops or more, according to its effects.

Of the vegetable tonics, Peruvian bark will be found the most powerful. Cullen says that he found it remarkably useful in this disease. Gentian, likewise, and other bitters, have occasionally been of service. De Haen used the leaves of the Seville orange-tree as a stimulant and tonic in spasmodic diseases, with considerable success.

Iodine is a medicine which has lately been used with some success in chorea, probably from possessing a tonic and stimulating power. Dr. Manson has published a number of cases which were successfully treated by it, in combination with mild cathartics. (Medical Researches, &c. p. 187 et seq.) Dr. Gibney, of Cheltenham, has also published two cases in which it was used with success along with other medicines, (Medical Gazette, vol. i. p. 54;) and Dr. Peltz relates a similar case in the Philadelphia Journal. (See Med. and Phys. Journ. vol. lix. p. 454.) It may be given in the form of tincture or the solution of the hydriodate of potass. The former, Dr. Manson directs to be made by dissolving twenty-four grains of iodine in an ounce of rectified spirit; and the dose may be from five to ten or fifteen drops three times a day, in some distilled water. He makes the solution by dissolving twenty-four grains of the hydriodate of potass in an ounce of distilled water; the dose is ten drops to twenty. As the preparations of iodine, however, have been made of various strength by its various advocates, and will probably continue so until admitted into our pharmacopœiæ, they ought to be administered with due consideration; very mischievous effects, and in some cases an affection not unlike chorea itself, having been occasioned by its incautious exhibition. (See BRONCHOCELE.)

Of the remedies used for the purpose of giving tone or strength to the system, cold bathing and cold affusion are not to be overlooked. [The Russian bath and sulphurous baths have, likewise, been found serviceable. (*Practice of Medicine*, 2d edit. ii. 244: Philad. 1844.)] Electricity and galvanism, also, have been recommended, and the former employed in some instances [especially of late, by Drs. Addison and Golding Bird] with advantage.

Narcotic medicines have been frequently used with benefit, though they have occasionally been useless if not injurious. Stoll used the extract of belladonna, in doses of one sixth or one fourth of a grain every six hours, with great advantage; and Cullen says that he found opium very generally useful in chorea. (Materia Medica, vol. ii. p. 246.) Dr. Patterson mentions that an unusually severe case in the Bristol Infirmary was cured by opium and camphor; and Mr. Bedingfield tells us that the only case under his observation there which resisted the oxyd of zinc, was cured by laudanum and tartarized antimony. Digitalis has by some been occasionally found of service; and in the twenty-eighth volume of the Edinburgh Medical and Surgical Journal two cases are related in which the convulsive motions ceased under the use of hydrocyanic acid, preceded by purgatives. Some cases are related in the Medical and Physical Journal, in which a speedy cure was effected by colchicum, without its producing a cathartic, or any other sensible operation. (Vol. xxxi. pp. 181, 232.)

[Testimony has been afforded in favour of cimicifuga, which, in large doses, is an acro-narcotic. The dried root may be given in powder in the dose of a teaspoonful three times a day; or it may be given in decoction. (*New Remedies*, 4th edit. p. 164: Philad. 1843.)]

Musk, valerian, camphor, and other antispasmodics have occasionally been given, but in general without any benefit. Two cases however, are related in the fifth volume of the Medical Transactions, in which Drs. Powell and Maton found the first of these successful. The cardamine pratensis, also, had at one time a reputation in this disease. Sir George Baker published some cases of spasmodic affection, two of them chorea, in which it appeared to him to be of decided benefit; but there is little confidence now placed in it.

Although we conceive that in the great majority of cases chorea will be most successfully treated by means of purgatives and tonics, more especially the latter, it cannot be denied that instances have occurred in which there has been such affection of the head as to indicate the propriety of local, or even general bleeding, and other antiphlogistic means of cure. Bleeding, as we have seen, was one of Sydenham's remedies; and Cullen admits that he had in some instances found it useful, though frequently very hurtful. In one case, Dr. Robert Watt found that it had an almost immediate effect in allaying the convulsive movements. (Cases and Observations, &c. Paisley, 1808.) Dr. Clutterbuck has in a number of instances prescribed it, at intervals of a few days, ten or a dozen times, and even oftener, without any other active remedies, and without failing of success. (See his Lectures. Lancet, vol. xii. p. 421.) Dr. Armstrong, who trusted principally to cathartics, aided by diet, exercise, air, and the tepid bath, to restore the functions of the skin, cautions us against the free use of the lancet, and mentions a case, as we stated above, in which it nearly proved fatal. (Lectures. Lancet, vol. viii. p. 70.)

The use of external counter-irritants has often been of much service, especially when there has been any considerable affection of the head. Blistering the scalp, or rubbing it with tartar-emetic ointment, has been adopted, with this indication. The same remedies have been applied in the course of the vertebral column, a mode of treatment which accords with the conclusion drawn by Magendie, from the experiments presently to be recounted, that the direct *cause* of motion is in the spinal chord; and which would therefore promise, as it has afforded, in cases of a more permanent description, especial advantage. For such purpose, also, a seton in the neck, the moxa, &c. have been recommended. As the disease often arises about the period of puberty, from impeded menstruation, the application of a blister to the sacrum promises to be useful. Dr. Chisholm states that he found it successful after purgatives and antispasmodics had failed. (On the Climate and Diseases of Tropical Countries, p. 97, 8vo. 1822.) Mr. Swan, of Lincoln, found it to have an immediate effect in allaying the convulsive motions. (Edinburgh Med. and Surg. Journal, vol. xxii. p. 94.)

When chorea arises from the coming of the second set of teeth, lancing the gums, or the removal of some of the first set, will be proper. Instances in which the disease was speedily removed in this manner by Drs. Monro and Gregory, are referred to in the first volume of the Edinburgh Medical and Surgical Journal, p. 32.

Darwin, as he conceived the disorder to arise sometimes from the itch being hastily repelled, begins his directions for the cure by telling us to "give the patient the itch again." (Zoonomia, vol. iv. p. 291.) He also furnishes us with an ingenious suggestion, that perpetual and repeated efforts should be made to move each limb in the designed direction, in expectation of the same good effects that follow from such efforts in stammering. Independently of any other benefit from such an exercise, one evident advantage would be, the abstraction of the patient's attention from his complaint — a matter of no slight importance in this and many other convulsive diseases. M. Louvet Lamarre found the exercise of the skipping-rope of much use in one instance. (Med. and Phys. Journ. Vol. lx. p. 89.) On this subject Dr. Mason Good remarks that a long and punctual discipline of the affected limbs to regular and measured movements, might, where the disease is not very severe, recal them to their wonted order and firmness; and adds that with this view the exercise of dancing, by which the original chorea Sancti Viti is said to have been cured so singularly, may be well worthy of attention. (Study of Medicine. Vol. iv. p. 485.) The influence also of music alone, independent of the measured efforts in dancing, ought not to be overlooked. In some of the diseases resembling the original St. Vitus's dance, as we shall presently see, an extraordinary passion for music has been among the most prominent symptoms; and Dr. Armstrong relates a case in which music had the effect of procuring sleep, and of ultimately curing the disease altogether, after it had resisted purgatives, sulphate of zinc, the arsenical solution, and various other means. (Lectures. Lancet. Vol. viii. p. 70.) When the *will* retains any power over muscular action, as it does in the ordinary form of the malady, it might be expected that such power, in a person susceptible to music, would be irresistibly or unconsciously exerted, to reduce the erratic movements as much as possible into harmony with its measured cadences. Nor will this appear fanciful to any one, who, being endowed with a musical ear, may have experienced how difficult it is, while music is sounding, even to obey the will in movements which do not accord with its measures.

[Under the head of chronic chorea, Dr. Watson (*Lectures on the Principles, &c. of Physic*, Amer. edit., p. 364: Philad. 1844,) has placed *partial choreas*, *tics*, *spasmodic tics*, or *nervous tics*, which consist in the most irregular and fantastic movements of certain muscles,—at first dependent upon bad habits, badly regulated volition, but subsequently executed independently of all volition. At times, they arise in consequence of some morbid condition of the nerves, and in spite of every effort of the individual. There is no plan of treatment which can be serviceable in such cases. Mental attention, with appropriate revulsion, may be sufficient; but if not, every other agency must fail. There is no danger, however, in these affections.]

We shall now advert to those singular affections which seem to have been erroneously classed with the foregoing disease, as well as to some others which appear to have been equally entitled to the appellation of chorea.

There is the following curious account of the original chorea Sancti Viti, in Burton's Anatomy of Melancholy. "Chorus Sancti Viti, or St. Vitus's dance; the lascivious dance Paracelsus calls it, because they that are taken with it can do nothing but dance till they be dead or cured. It is so called, for that the parties so troubled were wont to go to St. Vitus for help; and after they had danced there a while, they were certainly freed. 'Tis strange to hear how long they will dance, and in what manner, over stools, forms, tables; even great bellied women sometimes, (and yet never hurt their children,) will dance so long that they can stir neither hand nor foot, but seem to be quite dead. One in red clothes they cannot abide. Music above all things they love; and therefore magistrates in Germany will hire musicians to play to them, and some lusty sturdy companions to dance with them. This disease has been very common in Germany, as appears by those relations of Schenkius, and Paracelsus in his Book of Madness, who brags how many several persons he hath cured of it. Felix Platerus (de Mentis Alienat. cap. iii.) reports of a woman in Basil, whom he saw, that danced a whole month together," (Vol. i. p. 15. 8vo. edition. London, 1826.) This malady appears to have been generally considered as a disease of the mind, and we learn from Horstius and others, that it was liable to recur every year at the same period. The movements do not seem to have been actually spasmodic, but rather to have arisen from an irresistible propensity to muscular action, increased to a sort of phrenzy by the sound of music and the force of imitation. The frequency of the disease, as reported, however, gives rise to suspicions of imposture.

Baglivi, who has given us an account of somewhat similar symptoms arising from the bite of the tarantula, or venomous spider, in Apulia, and cured exactly in the same manner, states that the disease was very often counterfeited by the women, who in that country lived solitary lives, for the purpose of enjoying the agreeable diversion of music and dancing, which was only allowed to those afflicted with the malady. "In fine," says he, "the musical entertainment of this country" (in allusion to the mode of curing the disease) "is so very agreeable to the women, that 'tis a proverb with us, '*Il carnevaletto delle donne.*'" He informs us, however, that there really was an unfeigned disease arising from the bite of the tarantula; Sauvages has named it tarantismus; and says that "those who are stung die in a little time without the present assistance of music, all other remedies giving no relief." His description of the symptoms and the mode of cure are very singular. "A few hours after the bite," says he, "the patient is seized with a great difficulty of breathing, a heavy anguish of heart, and a prodigious sadness," &c. The malady, "after the sharp fit of the violent symptoms, which appear for the first days, is over, ends at last in a peculiar kind of melancholy, which continually hangs upon the sick person, till by dancing, or singing, or change of air, those violent impressions are quite extirpated."—"Many of these persons are never well but among graves and in solitary places; and they'll lay themselves along on a bier, as if they were really dead; they'll throw themselves into a pit as if they were in despair. Maids and women, otherwise chaste enough, without any regard to modesty, fall a sighing, howling, and into very indecent motions, discovering their nakedness; they love to be tossed to and again in the air; and the like. There are some that will roll themselves in the dirt like swine, and are mightily pleased with the exercise. Others, again, you cannot please, unless they be soundly drubbed on the breech, heels, feet, back, &c. And there are some that take a great pleasure in running. There are also curious observations made about colours; some of which are very agreeable to those persons, as others are offensive to them." In describing the manner in which they are worked upon by music, he says, "When any are stung, shortly after it they fall down upon the ground, half dead, their strength and senses going quite from them. Sometimes they breathe with a great deal of difficulty, and sometimes they sigh piteously; but frequently they lie without any manner of motion, as if they were quite dead. Upon the first sounding of the music the forementioned symptoms begin slowly to abate; the patient begins to move his fingers, hands, feet, and successively all the parts of the body; and as the music increases, their motion is accelerated; and, if he was lying on the ground, up he gets, (as in a fury,) falls a dancing, sighing, and into a thousand mimic gestures. These first and violent motions continue for several hours, commonly for two or three. After a little breathing in bed, where he is laid to carry off the sweat, and that he may pick up a little strength, to work he goes again, with as much eagerness as he did before, and every day spends almost twelve hours by the clock in repeated dancing; and, which is truly wonderful, so far is he from being wearied or spent by this vehement exercise, that (as they say) it makes him more sprightly and strong. There are, however, some stops made; not from any weariness, but because they observe the musical instruments to be out of tune; upon the discovery of which, one would not believe what vehement sighings and anguish at heart they are seized with; and in this case they continue till the instrument is got into tune again, and the dance renewed. This way of dancing commonly holds four days, it seldom reaches to the sixth. Every patient has not only his particular tune, but also his particular instrument; some a pastoral pipe, others a little drum, cittern, harp, timbrel, violins, and pipes of several sorts. Here 'tis remarkable that sometimes the musicians will tune three or four different sorts of sounds without having the least effect upon the patient. But when they fall into a tune that 's accommodated to the poison, they presently receive the benefit of it. However, this must be taken for a truth, that how much soever they vary in their particular tunes, yet they all agree in this —to have the notes run over with the greatest quickness imaginable, (which quickness of sound is commonly called *tarantella.*) And therefore the players that have not their lesson to learn in these matters, easily discover the cheat of the women; for if they find that they presently take any motions, and jog on indifferently, without any regard to the swiftness, slowness, or other difference of sounds, they give to understand that the honest woman is but in jest, and afterwards experience puts the matter out of doubt," (Baglivi's Practice of Physic, p. 363 to 382, *passim.* London, 1704.) He states that the disease, like the German chorea Sancti Viti, generally returned about the same time of the year that the patient was stung; and seems much at a loss to understand either how it was produced, or in what manner it was cured. He appears inclined, indeed, to account for the latter, by the profuse sweatings induced by the violent exercise; but he admits that the physicians could not cure it by artificial sweatings. A cony which was stung by a tarantula and died on the fifth day after, was not at all influenced by music. On opening it after death, he tells us that "the veins and arteries of the brain were swelled up, and the brain itself a little inflamed, and set about with blackish spots here and there. The lungs and other entrails were distended with clotted and black blood. In the ventricles of the heart were observed greater clots of blood, and small branches of a polypous concretion. There was abundance of serum lying about the outward parts of the brain. The other parts were sound and untainted." (Page 386.) There is a case related in the New York Repository, (Hex. ii., vol. i., p. 1-11. Med. and Phys. Journ. vol. xv.), of a convulsive disease, ascribed to the bite of a spider, which, like that from the tarantula, was most effectually counteracted by music. In the latter malady, as as in the original St. Vitus's dance, the principal peculiarities were the excessive love for music, and desire of muscular motion, especially in regulated measures. In both there was a liking or dislike of certain colours; and in both, the imagination at least, if not the intellect, was from the commencement disordered. Such, however, it is almost needless to observe, are far from being the characteristics of the ordinary chorea.

Mr. Kinder Wood has related a singular case in the Medico-Chirurgical Transactions, which he names chorea Sancti Viti; and it certainly had much in common with the original disease of that name. The patient, a married woman, aged twenty-two, after complaining of severe pains in the right side of the face, succeeded by heaviness and wildness of the eyes, became affected with extraordinary involuntary motions, commencing in the eyelids, which were opened and shut with excessive rapidity. They then affected the muscles of the extremities. The palms of the hands were beat rapidly on the thighs, and the feet on the floor, the arms being at times extended, the palms turned outwards and inwards, and the backs of the wrists struck violently on each other, or the middle fingers on the palms of the hands with great quickness. The motions soon extended to the trunk of the body and the pelvis; and the patient was half raised from the chair, and instantly reseated in rapid succession. Sometimes she was forcibly thrown on her feet, when she jumped and stamped violently, and she had often a propensity to spring or leap upwards, and strike the top of the room with the palm of the hand. Frequently she would dance on one leg, holding the other with the hand. These attacks were accompanied with headach, sickness, and vomiting, which generally succeeded the affection of the eyelids. On the third day she began to strike the furniture and doors violently with her hand, and was greatly pleased with the sound. At length the bystanders observed that the strokes assumed a regular tune and measure, and the motions were changed into a step about the room, regulated by an air, or series of strokes upon the furniture as she passed. Though, previous to her illness, she could not even dance a country dance, she would now move about in all the elegance of a minuet. When she looked around, she had an irresistible propensity to spring up and touch little spots or holes in the ceiling; and she would dart the forefinger with amazing rapidity and precision through a hole in a wooden screen. A person, thinking he recognised the tune which she beat on the furniture, began to sing it, and she danced directly up to him, and continued dancing till she was out of breath. A drum and fife were now procured, and she immediately danced up to the drum, and as close to it as possible, till she missed the step, when the motions instantly ceased, and this was always found to be the case. The motions were always found to cease, also, when the measure was changed, or increased in rapidity beyond her power to keep pace with it. When a continued roll was kept up on the drum, it had likewise the effect of stopping the motions. Their approach was therefore watched, and by uniformly rolling the drum when it was observed, the chain of associations which constituted the disease was at length broken. Mr. Wood states that the alvine excretions were unnatural during the complaint, and that the menstrual discharge appeared on the evening of the day on which it ceased; together with an eruption on the skin, in diffused patches, of a bright red colour. Whether these were essential circumstances in the history of the case is a question worthy of consideration. Mr. Wood thinks that the case establishes the connection of such instances of inordinate muscular action with some peculiar state of the mind. He tells us, however, that the patient's spirits were good, her perception and judgment accurate and just; that during the absence of the paroxysms she went about many household affairs; and that she had a correct knowledge of her situation, and of the advantages she derived from the agency of the drum, with an anxious desire to continue its use. A subsequent less severe attack of the complaint disappeared under the use of aperients and tonics; and the third and last, which terminated in spasmodic affections of the abdomen, chest, neck, and face, seems to have been chiefly benefited by bleeding. It is curious that, after the nature of the motions was changed in this last attack, the drum had no effect upon them. (Medico-Chirurg. Trans. vol. vii.)

[In another work, (*Practice of Medicine*, edit. cit. ii. 295,) the author has given, on the authority of a young medical friend, an account of a singular affection said to be somewhat common in the southeastern portion of the state of New York, and known among the common people as the *magrums*. It is said to consist essentially in a spasmodic action of all, or nearly all, the voluntary muscles. In the involuntary movements, the upper part of the air-passages occasionally participate, as witnessed by a clucking sound in the neighbourhood of the glottis, and a manifest impediment in the powers of speech. The movements of the face, neck, extremities and body, wholly cease during sleep. The disease very rarely makes its appearance before adult life, and attacks after forty-five years of age are very rare. It rarely or never ceases whilst life lasts, and appears to be hereditary.]

Of the disease which has been at times prevalent in some parts of Scotland, and known by the name of "the *leaping ague*," the following is a concise description :—"Those affected first complain of a pain in the head or lower part of the back, to which succeed convulsive fits or fits of dancing at certain periods. During the paroxysm they have all the appearance of madness, distorting their bodies in various ways, and leaping and springing in a surprising manner, whence the disease has derived its vulgar name. Sometimes they run with astonishing velocity, and often over dangerous passes, to some place out of doors, which they have fixed on in their own minds, or perhaps even mentioned to those in company with them, and then drop down quite exhausted. At other times, especially when confined to the house, they climb in the most singular manner. In cottages, for example, they leap from the floor to what are called the baulks, or those beams by which the rafters are joined together, springing from one to another with the agility of a cat, or whirling round one of them with a motion resembling the fly of a jack." (Edin. Med. and Surg. Journal, vol. iii. p. 835, or the Statistical Account of Scotland, by Sir J. Sinclair, *passim*.)

The most recent published case of this disease, so far as we are aware, will be found in the 31st volume of the Edinburgh Medical and Surgical Journal. Mr. Crichton states that the patient was a girl fifteen years old, and that the affection was announced by frequent shakings, with foaming at the mouth, followed by coma. In addition to many of the symptoms mentioned in the foregoing passage, such as dancing, jumping upon the furniture of the room, running round a table, springing on the top of a door to swing backwards and forwards, leaping over a staircase at one bound, and desiring to spring out of a window; she had likewise the following singular affection: "she would occasionally converse with those in the room, but in a language that no stranger, and hardly even those of the family who were constantly beside her, could understand. This arose from her commencing the sentence with the last word, and very frequently pronouncing the words themselves with the last letter foremost. At times, when by no possibility she could make herself be understood by her parents or sisters, she became irritated, and would write down what she wished to convey; but her manner of writing was equally singular, beginning at the right edge of the paper, and writing backwards towards the left, the last word of the sentence first, and often the last letter of the word first; and this she performed with great rapidity, and seemingly without consideration." (Vol. xxxi. p. 300.) She had a propensity to secrete things; and so irresistible were the impulses to motion, that the strength of several people was insufficient to constrain her. Purgatives afforded her little benefit. Opium before the paroxysm sometimes prevented it; and the shower-bath cured the disease, though it produced locked jaw for eight days. The "leaping ague" may be said to consist, generally, of a morbid propensity to running, leaping, dancing, or tumbling, which the patient is unable to resist. The muscular motions, though in a great degree involuntary, are performed with more agility and exactness than usual; for the person affected can run with greater velocity, leap with greater vigour, and do feats which even professed tumblers could not equal, balancing the body with correctness, and dexterously avoiding dangers. It is scarcely necessary to point out how widely the disease differs in all these respects from the ordinary chorea.

M. Piedagnel has related the case of a man, who, after some symptoms of cerebral affection, was seized with an irresistible propensity to move forwards, only stopping when exhausted. Finding his apartment too confined for the gratification of his propensity, he would sally into the streets, and continue walking straight forward until he dropped down, and was obliged to be brought home in a litter. On opening the head, several tubercles were found, involving in a particular manner the anterior part of the hemisphere. (Journal de Physiologie, tom. iii. or Magendie's Physiology, translated by Dr. Milligen, 3d edit. p. 189.) In direct opposition to this case, Dr. Laurent, of Versailles, exhibited a young girl to the Academy of Medicine, who, in the attacks of a nervous disease, was irresistibly propelled backwards, and with some rapidity, being unable to avoid obstacles or hollows, and, consequently, receiving many bruises and falls in her course. (Magendie's Physiology, p. 191.)

An account of a very remarkable case, in which a young girl, in Renfrewshire, was affected with violent fits of leaping, dancing, running, crying, fainting, &c., was published at Edinburgh, in 1698. It was entitled "A True Narrative of the sufferings of a Young Girl, who was strangely molested by Evil Spirits, and their Instruments, &c." The disease being ascribed to witchcraft, a commission was appointed by the king to inquire into the matter, and seven unfortunate beings in consequence were condemned to the flames!

One of the most extraordinary cases of convulsive disease on record has been related by Dr. Robert Watt, of Glasgow, in the 5th volume of the Medico-Chirurgical Transactions, under the title of Chorea, or "Periodical Jactitation." The patient was a lively, but rather delicate girl, ten years old, from Ayrshire. She was first seized with excruciating headach, and almost incessant vomiting, increased by the slightest inclination of the body either backwards or forwards. These symptoms continued for a month, during which time she lost the power of speech and of walking. At the end of that time she was seized with a propensity to turn round on her feet, like a top, with great velocity, always in one direction, and was gratified when the attendants assisted her in increasing the rapidity of her movements. After continuing nearly a month these motions ceased, the headach returned with increased severity, and was succeeded by a total loss of power over the muscles of the neck. In a short time after, she was seized with a new kind of motion. She would lay herself across the bed, and, turning round like a roller, moved rapidly from one end of it to the other. The fits continued at first for about two hours; but they gradually increased to six or seven hours daily. On being carried into the garden, she rolled rapidly from one end of a walk to the other; and, even when laid in the shallow part of a river, though at the point of being drowned, she began to turn round as usual. Nor did the sudden dashing of cold water over her interrupt her movements. Her rotations were about sixty in a minute. In a month or six weeks, the movements became of an entirely new kind. The patient now lay upon her back, and, by drawing her head and heels together, bent herself like a bow, and then allowing her head and heels to separate, her buttocks fell with considerable force upon the bed. She repeated these movements ten or twelve times in a minute; at first for six hours daily, and at length for fourteen. After this had continued for about five weeks, she was seized with a propensity to stand upon her head with her feet perpendicularly upwards. As soon as the feet were elevated in this manner, all muscular exertion seemed to be withdrawn, and the body fell down as if dead; her knees first striking the bed, and her buttocks striking her heels. This was no sooner done than she instantly mounted as before, and continued to do so, from twelve to fifteen times in a minute, for fifteen hours a day. The disease left her after a spontaneous diarrhœa, having previously resisted cathartics, an emetic, local bleeding, blistering, a seton in the neck, &c. Dr. Watt states that another instance, similar to this, had occurred some years before in Ayrshire, and that he had been informed of a third in the same county: in both of these, also, the patients were young women. There is a case mentioned in the 3d volume of the Edinburgh Medical and Surgical Journal, page 437, in which a young girl was affected with a species of motion similar to the first which Dr. Watt's patient presented. "Her complaint began with convulsions of the diaphragm and abdominal muscles, producing an action like retching, or something between hiccough and retching. Convulsions of the extremities supervened, and in the paroxysms, which lasted several hours, she performed the most singular motions; at one time bounding upon her bed, then turning round and round, as upon an axis; then running round the outside of the ropes by which her hammock was suspended." She had several paroxysms a day, coming on at stated intervals, and she had constant pain, which she referred to the region of the uterus. Nothing was discovered on dissection after death, which could at all explain the nature of the disease: some time before she was affected, she had rather a severe fall upon her head.

Mr. Hunter, of Glasgow, relates a case in which the principal symptom was a convulsive rotation of the head and trunk; he entitles it, therefore, "*rotatio*," or chorea. The patient was a female, twenty-three years old, and unmarried. While lying on her back, the head was rolling from side to side, with a quick, regular, and continued movement. When a fit came on, "she sprang with a strong convulsive movement from her back, and sat up in the bed. The rotatory motions of the head now became furious and alarming. They were executed with such immense rapidity, that it was difficult even for eye to follow them. She appeared absolutely to be looking backwards and forwards, and in every direction, at the same instant. The movements, while in the sitting posture, were not confined to the head; for the whole trunk likewise partook of the rotatory motions, the breech being the pivot upon which the whole turned. These convulsive motions continued about a minute, when they took a new but equally strange direction. The flexor and extensor muscles of the head and trunk were alternately called into action, and without the breech of the patient moving from its first position, her head was rapidly carried forwards to her knees, and backwards to her pillow, for about half a minute, when the paroxysm ceased, and left the patient greatly exhausted." (Edinb. Med. and Surg. Journal, vol. xxiii. p. 261.) She was perfectly rational, but the external senses were blunted and torpid. She sometimes had fifty paroxysms in a day. The disease appeared to commence in the uterine region, where there was pain on pressure; and it was cured by rubbing tartar emetic ointment on the scalp, and along the course of the vertebræ. A case in some respects similar to this has occurred in our own practice, in the person of a young woman, who was affected for a long time with rotation of the head, without pain, but accompanied by intolerance of light. The motions, however, were far more gentle and slow than in Mr. Hunter's case, and they were unintermitting.

A patient attended by Dr. Conolly became subject, about the period of the cessation of the catamenia, and when menstruation had become irregularly performed, to violent paroxysms of rotation: they occurred many times in a day, and were always preceded by an inordinate disposition to talk. When the fits came on, the head was forcibly rotated from side to side about eight times in a second, and the paroxysm commonly lasted three or four minutes. In this case, the affection yielded to cupping behind the neck, application of leeches to the head, and the persevering use of aloetic purgatives.

Another singular form of disease, which has at times been ranked with chorea, is that affection, by some authors called *malleatio*, and consisting, principally, of a striking of the knees with one or both hands, as with a hammer. The hands are generally open, but sometimes they are clenched. Morgagni mentions a case of this description, in which one hand was convulsed; on extending any of its fingers the other hand became affected also; and if attempts were made to arrest the motions by force, they became both more violent and more general. We ourselves recollect the case of a man, in the Hampshire County Hospital, in whom there was a constant and uniform striking of the palm of one hand upon the side of the thigh, to such a degree, as speedily to wear out the part of his dress on which it fell.

In the preceding cases of anomalous convulsions, it will be observed that there was for the most part a periodical return and intermission of the spasms, as well as some method or regularity in the movements themselves. In both these respects they differ from the common chorea of this country. Other cases have been met with, occurring in paroxysms, but in which the motions were obedient to no rule or method. Dr. White, of York, describes a case of this kind in the fourth volume of the Edinburgh Medical Commentaries, p. 326, in which the muscles of various parts were, not simultaneously, but in succession, painfully convulsed, producing appearances so grotesque as to defy description. Three cases, occurring in one family in the county of Rutland, are related by Dr. Armstrong, in the ninth volume of the same work, p. 317, in which the patients were affected periodically, and suddenly, with fits of shrieking, jumping, writhing, &c. The disease first occurred after hooping-cough, and Dr. Armstrong considered it as epileptic.

There are some singular instances recorded of affections like the last being propagated by sympathy or imitation. These have generally been attended, and in the first instance, excited by religious or some other species of enthusiasm. This was strikingly the case in that extraordinary epidemic, as it has been called, which prevailed in 1742 in the parish of Cambuslang, in Lanarkshire, during the ministry of Mr. Macculloch, and produced by his preaching and exhortations on the subject of regeneration. (Edinb. Med. and Surg. Journ., the Inquirer, No. 11), vol. iii. p. 441). A similar epidemic occurred in the western districts of America, in consequence of the electrical spread of religious enthusiasm throughout the states of Tenessee and Kentucky, about the year 1800. Dr. Robertson, who published an account of it, states that the converts indulged in alternate fits of coughing, laughing, singing, shouting, and extravagant gesticulations, until, at length "to their own astonishment, and the diversion of many of the spectators, they continued to act from *necessity* the curious character which they had commenced from *choice*."* He informs us that the convulsions were generally in the muscles of the neck, trunk, and superior extremities; and that they were sometimes so violent as to throw the patient on the ground, "where, for some time, his motions resembled those of a live fish when thrown on land, more than anything else."

M. Magendie relates a case of the most extraordinary nature, in which the power of the will over the muscular motions was, at intervals, entirely lost; but instead of the muscles being paralysed or remaining at rest, they were abandoned to the most irregular and indescribable movements for hours together. After stating that the disease was preceded by great mental anxiety, followed by melancholy, the understanding remaining however entire in all other respects, M. Magendie describes the peculiar symptoms of the case in the following words: "It is impossible to paint, by language, the variety and oddity of his motions and positions. Had he lived in the times of ignorance, he would, beyond all doubt, have passed for one possessed; for his contortions were so far removed from the motions proper to mankind, that they might easily have passed for diabolical. It was worthy of remark that, in the midst of these contortions, in which his slender and pliant body was sometimes carried forward, sometimes thrown back, or to one side, like certain tumblers, he never lost his equilibrium; and that in the multiplicity of attitudes and singular motions which he exhibited for several months, he never once happened to fall. At certain times his motions would pass into the train of ordinary actions. Thus, without the least participation of his will, he was seen to rise and walk with rapidity, until he met with a solid body that opposed his passage. Sometimes he walked backwards with the same readiness, and was only stopped by a similar cause. He has often been observed to re-assume the power over certain motions without being in any way capable of directing others. Thus his arms and hands frequently obeyed his will, and more frequently still, the muscles of his countenance and speech. It was sometimes possible for him to retrograde in an instant, where progression forwards was anyhow prevented; and he then employed that retrograde motion to direct himself towards objects to which he wished to attain. Finally, these movements, which might be called automatic, never lasted an entire day. He enjoyed pretty long quiet intervals between the accessions; his nights were always tranquil. Although his muscular contractions were extremely violent, even to the extent of producing abundant sweats, when they had ceased, he perceived no sensation of fatigue in proportion to the efforts which he had made; as if the intellectual action which we exert to excite our motions were that which in the healthy suffers most exhaustion." (Compendium of Physiology, pp. 201 and 202).

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* Edin. Med. and Surg. Journ vol. iii. p. 446; or an Inaugural Essay on Chorea Sancti Viti, by Felix Robertson, of Tennessee. 8vo. Philadelphia, 1805.

The causes of such anomalous cases of convulsion, and the manner in which they operate, are exceedingly obscure. Modern physiologists, however, have afforded us some light on the subject. Thus, Magendie has, by experiments on some of the lower animals, shown great reason to believe that the *will* has more particularly its seat in the *cerebral* hemispheres, while the direct cause of motion is in the spinal marrow. We can easily conceive, therefore, says he, "why, in certain cases, these motions are not produced, though commanded by the will; and why, in certain circumstances of a contrary nature, very extensive and energetic motions are developed without any participation of the will." (Op. cit. p. 202.) In some of the following experiments confirmatory of this view, it will be observed that many of the anomalous symptoms in the cases we have just related, were produced by artificial means.

M. Magendie found that the cerebral hemispheres might be deeply cut into, or even entirely removed, provided the corpora striata were not injured, without any marked alteration of motion taking place. In a number of cases he has seen birds, reptiles, and fishes, run, leap, and swim, after the hemispheres were removed. Neither does the longitudinal section of the corpus callosum, or its entire removal, produce any additional effect upon the motions. But if the corpora striata be removed, the animal immediately darts forward, and runs rapidly, as if impelled by a power within which it cannot resist. This effect arises from the destruction of the white and striated portion of these bodies, for the removal of the brown matter does not produce any change in the movements of the animal. In unison with these facts, M. Magendie has opened several *immoveable* horses, or horses that cannot go backwards, though they can move forward with rapidity; and he has in all of them found a collection of water in the lateral ventricles, which must have compressed the corpora striata, and had even disorganized their surface. He considers it extremely probable, therefore, that there exists in man and the mammalia a force or impulse which tends to carry them forward, and which in a state of health is directed by the will. Again, both he and others have found that lesions of the cerebellum cause animals to move backwards contrary to their will. He found also that injuries of the medulla oblongata produce the same effect. Pigeons, into which he forced a pin through that part, constantly receded, for more than a month, and even *flew* backwards. The energies of the cerebellum and medulla oblongata appear, therefore, to be directly opposed to those of the corpora striata; those of the one counterbalancing the other in the sound state, and being rendered preponderant, or otherwise, by disease or injuries of the respective parts. A still different effect was produced upon the movements of the animals when the peduncles of the cerebellum were divided. In that case the creature rolled laterally upon itself, as if impelled by a great force; the rotation being made upon the side on which the peduncle was cut; the animal making sometimes more than sixty revolutions in a minute, and the motions continuing frequently for eight days without a moment's interval. The same effect was produced by vertical and entire sections of the cerebellum; the motions being more rapid according as the section was nearer to the origin of the peduncles. When the cerebellum was cut vertically into two perfectly equal parts, the animal first rolled once or twice to one side, and then as often to the other, as if for relief. Similar effects to these were obtained by sections of the pons varolii, which, together with the peduncles of the cerebellum, forms a circle round the medulla oblongata. Sections to the left of the median line produced rotation to the left, and sections on the right side of the line, rotations to the right. A movement in a circle, resembling that of the *manège*, was occasioned by a section of the medulla oblongata, where it approaches the exterior of the anterior pyramid. If cut on the right side, the animal turned to the right; and when cut on the left, it turned to the left. Lastly, when the spinal marrow was separated from the brain by a section made behind the occipital bone, the influence of the will appeared to be entirely cut off from the movements; which, however, did not cease, but became very irregular in extent, rapidity, duration, direction, &c. (Compendium of Physiology, p. 187 to 193—200 and 201.)

These experiments, as well as those of Rolando and of Flourens, are strongly in favour of the opinion, that individual parts of the brain answer individual purposes, so far, at least, as regards the power of regulating our movements. Such singular and anomalous instances of muscular action, therefore, as those we have related, may arise from causes which produce an excitement or oppression of certain parts of the encephalon, without affecting the other parts. Certainly in many, or most of the cases, marks of cerebral affection were observed. In M. Piedagnel's case, as we have already mentioned, several tubercles were found pressing upon the brain; in the immoveable horses, water was uniformly discovered in the ventricles; in the rabbit that died from the bite of the tarantula there were marks of inflammation, congestion, and effusion of serum on the brain. In the leaping ague, one of the first symptoms is pain in the head. Dr. Watts's case was preceded by excruciating headach and incessant vomiting; Mr. Kinder Wood's was attended with the same symptoms; and the patient whose case is referred to in the third volume of the Edinburgh Medical and Surgical Journal, had had a severe fall on the head some time previous to the convulsive affection. Although the existence, therefore, of partial pressure or other affections of the brain may not in all cases have been discovered, or even discoverable, — since, unless it arise from a permanent cause, it may be impossible to detect it after death, — yet it must be admitted that there are strong grounds for attributing these cases to such an origin, and for directing our remedial attentions accordingly. Whether the strange mental or monomaniacal symptoms which have sometimes accompanied the convulsive motions, may, as well as the latter, be attributed to an affection of certain individual parts of the brain, is more problematical. The disciples of Gall and Spurzheim, however, would doubtless advert with complacency in Mr. Wood's case to the prominent symptoms of excitement in the vicinity of their organs of *time* and *tune*, as confirmatory of their doctrines. [See Watson, *Op. cit.*, p. 367.]

ANDREW CRAWFORD.

[CIRRHOSIS. (See LIVER, DISEASES OF THE.)

CIRRHOSIS OF THE LIVER. (See LIVER, DISEASES OF THE.)

CIRRHOSIS OF THE LUNG. Under this name, Dr. Corrigan, of Dublin, has described a pathological condition, the general character of which is a tendency to consolidation or contraction of the pulmonary cellular tissue with dilatation of the bronchial tubes. The diminution of the lung is regarded by him as the first step of the disease, and the dilatation of the bronchia the consequence of this. The primary seat of the disease he considers to be—the web of cellular tissue, constituting the matrix of the lung, which has a tendency to contract, so as to produce, when the disease is advanced, a very considerable obliteration of the air-cells. (*Dublin Med. Journal*, May, 1842, and the writer's *Practice of Medicine*, 2d edit., i. 201: Philad. 1844.)]

ROBLEY DUNGLISON.

CLIMACTERIC DISEASE. (See AGE.)

CLIMATE. The general import of the word climate (from κλίμα, regio,) is sufficiently understood, although it is not easy to give an accurate definition of it. In medicine the term is used to designate those habitual conditions of the atmosphere, in connection with the state of the surface, soil, exposure, &c. of particular countries or districts, which are capable of influencing the health of persons inhabiting them.

The subject of climate may be treated under two distinct divisions, physical and medical. The consideration of the former, or physical climate, we must leave to the natural historian, as not coming properly within the scope of this work, although affording matter of the greatest interest to the medical philosopher. The latter or medical climate, may also be considered under two separate heads—as it affects the body either in causing or curing disease. The latter part of the subject, or the consideration of climate as an agent in the prevention and cure of disease, is that which we propose to treat in the present article; availing ourselves, however, of the physical characters of climate and the geography of disease, as far as a knowledge of these departments of the subject tends to illustrate the medical application of climate.

We shall first give a brief account of the climate of the principal places in our own Island, in the South of Europe, and in the Northern Atlantic, which have been most frequented by invalids; and endeavour, at the same time, to determine their respective characters and their relative merits. We shall then point out the diseases which are most decidedly benefited by change of climate, and the particular situations most suitable to each.

The influence of climate on the animal economy is now so well known and appreciated by the more observant part of the profession, that it would be a waste of time, in a work of this nature, to enlarge upon the advantages which may be derived from a well-timed and judicious change of it in the treatment of disease. The removal, for example, from a cold, humid, and variable climate, to one which is warm, dry, and more equable, is well known to be productive of the most beneficial effects on a large class of invalids, when other therapeutical agents are of little avail; while, on the other hand, a contrary change is as certainly attended by a deterioration of the health, and often by the supervention of fatal diseases, even in persons previously in the enjoyment of good health.

If our limits permitted, it would not be difficult to account for many of the effects of climate, whether favourable to health or the reverse. For instance, when we reflect on the powerful influence of a warm dry air on almost all the functions of the animal economy, but more especially its obvious agency in promoting an equable distribution of the circulating fluids over the whole system, and particularly its effect in augmenting the activity of the circulation in the capillaries of the surface, and in diminishing in the same proportion the congestion of the internal vessels, (a state which very generally obtains in chronic ailments,)—we have a satisfactory explanation of much of the benefit which invalids experience by a removal from a cold to a warm climate. If we take into account also the effect of the continual action of a bland atmosphere on the extensive surface of the respiratory organs, both as abating irritation of the lungs, and enabling them more effectually to produce those changes in the blood that are essential to health, we have another very obvious explanation of the results observed. And if to these we add the influence produced on the nervous system generally, on the external senses, and through them on the mind, and, reversely, the re-action of the mind on the bodily functions — we need have little difficulty in accounting for the beneficial influence of the change of climate which we are now considering.

The contrary state of the functions and of the circulation, and the diminished energy of the nervous system induced by a change from a genial to a cold and humid climate, will with equal readiness account for most of the evil consequences so frequently observed under such circumstances.

Independently, however, of these effects, more directly attributable to climate, properly so called, there are many incidental circumstances attending a change of this kind, which have often no small share in improving the condition of the invalid. The hopes inspired by the measure itself, the influence of the journey or voyage, the change of scene, of occupation, and often, also, the escape from business and other sources of discomfort and care, all claim a part in the benefit produced.

While all these circumstances will, therefore, have their due weight with the physician, when deciding upon such a change of climate as we are now contemplating, he must not omit, at the same time, to take into account the inconveniences and even disadvantages, which in many cases are inseparable from the removal of the delicate invalid from his own home and country. These latter considerations will rise in importance in his mind according to the advanced state of his patient's disease, and consequently the diminished prospect of permanent advantage from the measure. So many circumstances of a conflicting nature often present themselves for our consideration in such cases, that it is only by a comprehensive and dispassionate view of all the bearings of the case that we can come to a right decision, and then often not without difficulty. It is perhaps the rarer case, that we have merely to consider the nature of the patient's disease, and the probability of its being benefited or cured by any particular climate.

Among the numerous circumstances which require attention in recommending a change of climate, one of much importance is often entirely lost sight of, both by the physician and his patient:—we mean the necessity of perseverance in the regimen and mode of life which the peculiar nature of the disease demands. This must be urged upon the invalid as the condition on which alone he can expect to derive benefit from the prescribed measure.

We would press upon the minds of our professional brethren the importance of giving a full consideration to all the circumstances which have been just noticed; as we are satisfied, from ample observation, that change of climate has not hitherto been productive of all the benefit which it is calculated to effect,—nay, that it has often done positive mischief, chiefly on account of the inconsiderate and injudicious manner in which it has too generally been prescribed and carried into effect.

We shall now proceed to give some account of the individual places in this and other countries which have been chiefly resorted to by invalids, on account of the mildness or other peculiarities of their climates.

English Climates.—The great desideratum in this country is to find a mild climate and sheltered residence for our pulmonary and other delicate invalids during the winter and spring: we shall therefore direct our attention principally to this point.

Our warmest winter residences in England are mostly found on the southern and south-western shores; indeed it is their vicinity to the sea which in a great degree renders them warmer than the inland parts in their respective vicinities.

The mild region of England admits of a natural division into four districts or groups, each having some peculiar features in its climate which characterise it and distinguish it from the others, both as regards its physical and medical qualities. These are—

1. The *south coast*, comprehending the tract of coast between Hastings and Portland Island, including the Isle of Wight; 2. the *south-west coast*, from the latter point to Cornwall; 3. the district of the *Land's End;* and 4. the *western group*, comprehending the places along the borders of the Bristol Channel and estuary of the Severn.

South Coast.—The superiority of the climate of this district exists chiefly during the months of December, January, and February. In March the temperature of this coast, and that of the interior, (e. g. the vicinity of London, which we select as a convenient point of comparison,) is nearly the same. In April and May, the temperature of the interior rises above that of the coast and continues higher, though in a less ratio, through the summer months. In October the mean temperatures are again equal, and in November, that of the coast begins to exceed the interior. The only places on the south coast which we consider deserving of particular notice, are, Undercliff in the Isle of Wight, and Hastings and Brighton on the coast of Sussex.

Undercliff is decidedly the most sheltered and warmest of these places, and it has moreover this convenience over most of our other winter residences, that it also affords a good summer climate, a circumstance of considerable importance to many invalids. Unfortunately, at present, few can avail themselves of the advantages of this sheltered district, from the want of the necessary accommodations. [Of late, the accommodations for invalids have been greatly increased. (Sir James Clark, *The Sanative Influence of Climate*, p. 134. Lond. 1841.) The Isle of Wight presents a great variety of healthy and beautiful sites for different classes of valetudinarians, both as winter and summer residences.]

Hastings follows Undercliff in point of shelter and warmth during the winter and spring months. Its situation at the base of a range of steep hills, which protect it in a considerable degree from the north and north-east winds, render it a milder and more sheltered residence during this season than the other parts of the coast of Sussex.

[*St. Leonard's* is about a mile to the westward of Hastings. The climate of the two places is almost identical;—but the accommodations are much better at the former. (Sir James Clark, *op. cit.* p. 126.)]

Brighton differs materially in the character of its climate from both these places. It is more exposed to northerly winds, but the atmosphere is drier and more bracing. While inferior to Undercliff and Hastings as a residence in diseases of the respiratory organs accompanied with much irritation, it offers advantages over both to invalids of a relaxed and nervous habit who are not very excitable. Autumn is the season during which the climate of this place possesses the greatest advantages; and even to the end of December it is one of the mildest climates in our island, and most favourable for a large class of invalids; more especially for cases in which a relaxed state of the system is a leading feature.

Invalids who select the coast of Sussex as their winter residence, might find it advantageous to pass the autumn at Brighton and the winter at Hastings.

South-west Coast.—The winter climate of the south coast of Devon has long been noted for its mildness. The temperature of its more sheltered spots during the months of November, December, and January, (when the difference is greatest,) is, in the average, about five degrees higher than that of London during the same period: whereas, on the south coast, the difference scarcely exceeds two degrees. This superiority of temperature over London at both places, occurs chiefly during the night; though the days are proportionably warmer, and the temperature more steady on the south-west than on the south coast. In making this comparison, however, between these two districts, it is right to observe that Undercliff is not taken into the account for want of sufficient data.

Various places on the coast of Devonshire are held in repute on account of the beneficial effects of their climate, more especially in pulmonary diseases. The principal of these are *Torquay*, *Dawlish*, *Sidmouth*, and *Exmouth*. *Salcombe*, the Montpelier of Huxham, is unquestionably one of the warmest spots in our island during the winter; but it possesses few accommodations, and its sheltered climate is confined to too small a space to admit of its ever acquiring importance as a residence for invalids. Indeed, this limited character of the climate is the great defect of all the places on this coast, with the exception of Torquay. Here the invalid has the advantage of a considerable tract of sheltered country, some part or other of which will afford a protected ride or walk, in whatever direction the wind blows. Torquay is superior in this respect to every place in our island. Its position, also, on the southern declivity of a range of pretty steep hills, composed chiefly of calcareous rocks, renders it comparatively dry. Hence, while Torquay possesses all the advantages of the climate of this coast, its chief disadvantage (humidity) is felt in a less degree than elsewhere.

Land's End.—The only place in this district deserving particular notice is *Penzance*, which has long been frequented by invalids on account of the mildness of its winters. Penzance has a very peculiar climate, which depends on its almost peninsular situation at the south-western extremity of the island. A remarkable equality in the distribution of the temperature throughout the year, and throughout the day and night, is a striking character of this place. In this respect, indeed, the climate of Penzance is superior to that of the south of Europe, and the only climate which we have examined that excels it is that of Madeira. This peculiarity of the climate of Penzance will be shown at once by comparing it with that of London, where the difference between the warmest and coldest months is 26°, while at Penzance it is only 18°. In winter, Penzance is, on an average, nearly six degrees and a half warmer than London during the night, and but little more than three degrees during the day.

In other respects the climate of the Land's-End does not stand so high in a medical point of view. It is very humid; the quantity of rain which falls annually at Penzance being nearly double that which falls in London, and the number of rainy days much greater. This district is also proverbial for the frequency and violence of its gales; and Penzance, owing to its total want of shelter from the northerly and easterly winds, is colder during the spring than either Torquay or Undercliff. Hence it is that although Penzance possesses a decided superiority over all the other situations in our island in the mildness and equability of its winter climate, its humidity, exposed situation, and liability to winds, render it inferior to several other places as a residence for invalids.

In giving the above as the character of the climate of the Land's-End, we are fully borne out by the experience of Dr. Forbes of Chichester, who resided there for some years, and to whose excellent Medical Topography of this district we are chiefly indebted for our information respecting its climate, and the influence of this on disease.

Flushing, a small village in the vicinity of Falmouth, is the only other place in this district deserving notice. The position of Flushing differs from that of Penzance only in being somewhat protected from the north and east winds by a low range of hills which rises immediately behind it. But the place is extremely confined, and deficient in accommodations for invalids.

Before quitting the south-west coast and Land's-End, it is proper to remark, that, though varying somewhat in degree at different places, the predominant character of the climate is that of softness and humidity; on the system generally, it has a soothing but relaxing influence.

From this character of the climate of the whole south-western coast of our island, it will be at once understood that it is most suitable for the irritable and inflammatory habit, and least so for the relaxed nervous constitution; that in the dry, irritated conditions of the mucous membranes, with a parched state of the skin, it will prove beneficial; whild in the morbid states of the same membranes, accompanied with copious secretion, or when there exists a disposition to profuse discharges of any kind, it will prove injurious. Even many of those cases which are benefited by a temporary sojourn, would be injured by a permanent residence in this district. The climate, indeed, possesses qualities of so marked a kind, that when it ceases to do good, it generally begins to do harm; hence it will seldom be prudent, much less advantageous, for the invalid who has passed the winter and spring on this coast, to prolong his residence through the summer; he will in general do well to betake himself to a drier and more bracing air, especially if he intends to return the succeeding winter.

Unless the circumstances which we have just pointed out respecting the character and effects of this climate, and the nature of the constitution and diseases of the invalid, are kept in view, little benefit will be derived from a residence in Devonshire.

West of England.—*Clifton*, the only place in the western district which we deem it necessary to notice, has several local advantages, and possesses the best climate in the part of the country where it is situated. Compared with that of the south-west coast, it is more exciting, more bracing, and drier, but not so mild. It is therefore less suited for pulmonary and other diseases, accompanied with much irritation, and with a tendency to inflammation. On the other hand, it is better adapted to invalids of a relaxed, languid habit; and is also very beneficial in many cases of dyspepsia, in affections of the mucous membranes with much secretion, and in the scrofulous affections of young persons.

In making a selection among these, which we consider the best winter climates in our island, in any particular case, we must consider well the character of the patient's disease and the nature of his constitution, before we venture to decide upon the situation best suited to him. But by attention to these points, and to the qualities of the different climates, which we have endeavoured to state as clearly as the nature of the subject and the extent of our knowledge would admit, the medical practitioner will not err greatly. In order, however, to illustrate the subject further, we shall add a few more particular observations on the practical application of English climates to disease.

The climate of the south coasts of Devon and Cornwall will be found very efficacious in soothing an irritated and irritable state of the respiratory organs, and of the mucous surfaces generally; as in chronic inflammation of the fauces, and of the laryngeal, tracheal, and bronchial membrane, of a dry irritable character, or at least accompanied with little secretion, and highly susceptible of increased irritation from sharp, dry winds. In dyspepsia depending chiefly on an inflammatory condition of the mucous membrane of the digestive organs; in disorders of the uterine system, arising from a similar condition of the parts, giving rise to dysmenorrhoea; also in the numerous nervous affections originating in the disorders of these two influential classes of organs, this climate may be confidently recommended, and will generally be found beneficial. To these may be added cutaneous diseases of a dry, irritable character. On the other hand, in disorders of the same organs and parts attended with passive congestion, or very copious secretion; in dyspepsia from an atonic state of the stomach, and in disorder of the uterine system, accompanied with an excessive flow of the catamenia, or leucorrhoea; and, in short, in all diseases attended with a relaxed state of the system generally, benefit is not to be expected from the climate of the south-west coast; more especially if the invalid prolongs his residence beyond a few months. The climate of Clifton, as has been already remarked, will prove more favourable in the cases last referred to. Brighton also presents an excellent autumnal climate for such invalids, and to persons of little constitutional sensibility offers a good residence throughout the winter, provided the more sheltered situations be selected. Hastings is a residence better adapted to invalids suffering from pulmonary irritation. During the spring months, that is, after March, any dry sheltered situation in the milder districts of the interior we believe to be superior to the south coast, with the exception of Undercliff.

After this survey of the best winter climates in England, it may be expected that we should take some notice of our more salubrious summer residences. On this subject, however, it is not necessary to go into detail, as there is no lack of healthy situations to which our invalids may repair with advantage during this season. In the selection of a summer, as of a winter residence, the same circumstances require attention, both as regards the character of the climate and the nature of the invalid's disease. The milder and more sheltered situations must be chosen, even during this season, for delicate and very sensitive invalids; while for the relaxed and enervated, and those possessing less sensibility, the bracing air of the higher and drier localities will prove more suitable. To a large class of invalids our sea-side watering places offer a variety of excellent situations; and for those cases in which sea-bathing promises benefit, they deserve a preference over the interior, especially during the latter part of the summer and autumn. Several of our inland watering places, independently of the advantages to be obtained in many cases from the use of their mineral waters, afford good summer climates; and, indeed, some of them, more on this account than any other, have become places of fashionable resort. Among these we may mention *Malvern*, *Cheltenham*, *Leamington*, *Tunbridge Wells*, *Matlock*, *Buxton*, &c. When the intention is to use the mineral water, the climate must of course be made subservient to this object; but when a choice of waters is admissible, it is of importance to many invalids that the climate selected also be suitable to them. In general it will be advantageous to invalids who have taken a course of mineral waters at any of these places, to pass the autumn by the sea-side, as at some of the driest places on the south, or south-east coast. In the greater number of cases in which travelling is borne without inconvenience, several changes, or a succession of short journeys, will be more beneficial than a residence at any one place during the whole season. It is remarkable how such repeated changes, with frequent gentle exercise, especially on horseback, renovate the constitution enfeebled by disease, enable it to overcome many chronic affections, and contribute to the restoration of permanent health. But we shall have occasion to recur to this subject.

[The *Island of Bute*, which lies in the Frith of Clyde, about 18 miles below Greenock, resembles, in the character of its climate, the south-west of England and France, and the Channel Islands, although its temperature is considerably lower than any of these. As a winter residence for invalids, it is considered by Sir James Clark, (*op. cit.* p. 170,) to hold out considerable advantages to that class for whom a soft, equable, but rather humid atmosphere is indicated.

Cove, on the island of the same name in Cork harbour, has one of the mildest climates in Great Britain, corresponding in general characters, and its influence on diseases, with the south-west of England, and other similar climates. In equability of temperature, Cove is surpassed by few places. Recent observations have shown, that the mean difference of temperature of the days and nights rarely exceeds four or five degrees, and often, in as a recreation than for the removal of actual disease.

The diseases in which the climate of Italy proves most beneficial, are chronic bronchitis and rheumatism. We have, in particular, observed many decided examples of the beneficial effects of a residence at Rome in both these diseases. But it is still more in the numerous cases of deranged health which scarcely admit of being defined, though well known to the medical practitioner, that a tour and winter spent in Italy will prove beneficial. Such persons need not be limited to any particular situation, but may, with proper caution, visit the different places frequented by strangers in the south of Italy, and that even with greater advantage to their health than if they had remained stationary at any one of them.

These observations have reference to the climate of Italy during the winter and spring, that is, from October till May or June. To such as are under the necessity of remaining in that country through the summer, the baths of Lucca, Sienna, and the vicinity of Naples afford the coolest residences.

There may be several situations on the shores of the Mediterranean which have climates equal, and perhaps superior to those which have been mentioned. Malaga has been particularly mentioned to us as possessing a very mild winter climate; but our information respecting the south of Spain is too imperfect to enable us to speak positively on this subject. And even were the climate of that country superior to that of the south of Italy, the want of proper accommodations and the various comforts which are as necessary to the invalid as climate, forms an insuperable objection to them as places of residence for delicate English invalids.

The MEDITERRANEAN ISLANDS do not merit much notice. Some parts of the coast of Sicily afford a pretty good winter climate; but here again the difficulty of obtaining the necessary comforts, and even conveniences of life, renders them almost useless to English invalids.

This objection, however, cannot be made to *Malta*, the only island in the Mediterranean belonging to this country. All the wants of the invalid may be supplied here, and the packets which are established between this place and England afford the means of reaching it conveniently. But, unfortunately, the climate of Malta has little to recommend it to any class of invalids, and least of all to such as suffer from pulmonary affections. The arid nature of the soil, the quantity of impalpable dust which is suspended in the atmosphere whenever the weather is dry, the currents of cold air to which the capital (the residence of invalids) is subject during the winter, and the frequent and heavy rains which prevail during the same season, render it an unsuitable residence for patients of this class. It may not be irrelevant to mention also that phthisis carries off a large proportion of the inhabitants of Malta, constituting nearly one-tenth of the whole mortality, according to Dr. Hennen. Indeed, the full and satisfactory information respecting the medical topography of Malta, supplied by this gentleman, affords more than sufficient grounds for excluding it from the list of climates which promise any advantage to phthisical patients. We are not, indeed, aware of any class of invalids likely to derive much advantage from the winter climate of Malta, and we are not acquainted with any to whom its summer climate would not prove injurious.*

ATLANTIC CLIMATE. — The climate of the Northern Atlantic in the temperate latitudes is more steady than that of the Mediterranean, and imparts a similar character to the climate of its islands. Various groups of islands scattered over this ocean, between the 28th and 38th degrees of latitude, having been praised for the excellence of their climate, and occasionally frequented by invalids in consequence, deserve some notice in this place. The Azores, the Madeiras, and the Canary Islands in the Eastern, and the Bermudas and the Bahamas in the Western Atlantic, have all been recommended as suitable residences for persons requiring a mild and equable climate, and more especially for consumptive invalids.

As our information respecting the climate of Madeira is the most complete, we shall notice it first, with the view of making it a standard of comparison in estimating that of the other islands.

Madeira. — The minute and careful observations of the late Dr. Heineken and of Dr. Renton, for a series of years, have afforded us sufficient data to form an accurate estimate of the climate of this island; and although our materials for enabling us to judge of the other Atlantic islands are much less complete, they leave little doubt in our minds that Madeira is superior to any of them; while it affords conveniences in other respects as a residence for invalids possessed by none of them. The height of the central ridge of mountains which compose the greater part of this island, although it may detract somewhat from its warmth during the winter, contributes greatly to temper the heat of its summer. It gives Madeira the advantage of a cool land-breeze during the night, which, alternating with a refreshing sea-breeze in the day, moderates the summer heat in a very material degree; while the trade winds which prevail at this season in the latitude of Madeira, contribute also to its coolness and salubrity. The invalid, moreover, by choosing for his summer residence an elevated situation in the interior, finds a climate considerably cooler than that of Funchal which is situated on the sea-shore and affords the best winter residence.

Comparing Madeira with the south-east of France and Italy, we find that, although its mean annual temperature is only about six degrees higher than that of these places, this temperature is very differently distributed throughout the year, the range being far less at Madeira than in the most favoured spots in the south of Europe. Thus, while the winter is twelve degrees warmer than in Italy and France, the summer is five degrees *cooler*; and while the mean annual range at Madeira is only fourteen degrees, it is nearly double this at Pisa, Rome, Naples, and Nice. In the equable distribution of heat throughout the year, it possesses a similar superiority over the same places; for example, while the mean difference of temperature of successive months at Madeira is only two degrees, at Rome and Nice it is four, and at Pisa and Naples five degrees.

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* We refer those who desire to examine the facts upon which the above character of the climate of Malta rests, to Dr. Hennen's *Sketches of the Medical Topography of the Mediterranean*, &c. [See, also, Sir James Clarke, op. cit. p. 241.]

In the progression of temperature during the day, it maintains the same superiority; the mean range for twenty-four hours being ten degrees by the *register* thermometer, while at Nice it is nine degrees, at Rome ten degrees, and at Naples thirteen degrees by the *common* thermometer. In steadiness of temperature from day to day, (a very important quality in a climate,) Madeira excels all those places greatly. There is also a considerable difference in respect to the dryness of the two climates. Nearly the same quantity of rain falls at Madeira as at Rome; but there are only seventy-three days on which any rain falls, while at Rome there are one hundred and seventeen days. The rain at Madeira also falls at more regular seasons, chiefly in the autumn, the atmosphere being generally dry and clear for the remainder of the year.

The annual range of atmospheric pressure is very small, which is the case also at Rome and Naples.

From this comparison, the superiority of the climate of Madeira over that of the south of Europe will be at once seen. We shall have occasion hereafter to notice their comparative influence on disease.

Canary Islands.—These rank next to Madeira in point of climate. They are somewhat warmer; the mean annual temperature of Funchal, the capital of Madeira, being 65°, while that of Santa Cruz, the capital of Teneriffe, is nearly 71°. This excess of temperature, however, is not equally distributed over the whole year, the difference between the winter temperatures at these two places being considerably less than between their summer temperatures; while Santa Cruz is 7° warmer than Funchal in summer, it is only 5° warmer in winter. The temperature is also more equable throughout the year at Madeira than at Teneriffe; the difference between the mean temperature of summer and winter being 9° at the former place, while it is 12° at the latter. The want of sufficient materials prevents us from comparing the climate of Teneriffe more minutely with that of Madeira. It seems probable, however, that when we are better acquainted with the climate and topography of Teneriffe, we may find it a favourable winter residence. But whatever may be the merits of its climate, it is at present very deficient in the other requisites necessary to render it a suitable abode for delicate invalids.

The **Azores,** or **Western Islands,** as they are sometimes called, lie about 5° north of Madeira, and considerably more to the westward. In their external characters these islands resemble Madeira and the Canaries. We have not had the means of making ourselves sufficiently acquainted with the temperature of the Azores to speak very positively on the subject. The climate appears to be mild but somewhat humid; less warm than Madeira during the winter, and more oppressive during the summer. They certainly possess no advantages in point of climate over Madeira, while they afford few of the conveniences which that island offers to invalids.

[The mean in-door temperature of a room without fire, carpet, or curtains, in Villa Franca, on the southern coast of St. Michael's, during the period from Dec. 1838 to April 1839, was 60°.9, with a mean range of 3°.6. The mean out-door temperature, during the same time, was 60°.10, and the mean daily range 7°.6. The highest point to which the thermometer rose in the shade, between eight o'clock in the morning and ten at night, was 76°; and the lowest point to which it sank was 51°. The average out of doors was not, however, taken with the register thermometer; but it approximates the truth. Sir James Clark (*op. cit.*, p. 288,) is of opinion that a change from the Azores to Madeira, and from thence to Teneriffe, would prove, in many cases, more beneficial than a residence during the whole winter in any one of those islands.]

Bermudas.—This numerous cluster of small islands is in the same latitude as Madeira, and differs little from it in the mildness of its winter climate. From the stormy character of the Western Atlantic, however, these islands are much more liable to high winds in the winter than Madeira, while their low character and arid rocky soil render them extremely hot during the summer, and quite improper at this season for the residence of such invalids as are likely to be sent from this country.

Bahamas.—This is another and much more extensive group of low islands, farther south than any of those which have been mentioned, being only just beyond the limit of the tropics. The climate of the Bahamas has not much to recommend it. The winter and spring are considerably cooler than the same seasons in the West Indies, while the temperature of the summer and autumn is nearly the same as in those islands. During the winter the temperature is subject to rapid and considerable vicissitudes, and cold, harsh, northerly winds are not unfrequent. The close vicinity of the Bahamas to the North American continent no doubt has the effect of rendering the climate less equable than it otherwise would be, judging from what we know of insular climates generally in the same latitudes.

We may safely dismiss these two western groups with this brief notice; as from the character of their climates, their great distance from England, and the few local advantages which they possess, they are never likely to prove beneficial as a residence for invalids from this country. They are better suited, in point of climate, and more conveniently situated, particularly the Bahamas, as a temporary retreat for the inhabitants of the islands which we are now to notice.

West Indies.—Although these islands are not often resorted to by real invalids, yet there seems to exist, even among the profession, a vague idea that they afford a preferable climate to that of any of the places which we have noticed. That this opinion has been formed from an imperfect knowledge of the nature and effects of a tropical climate, we shall endeavour to show.

The mean annual temperature of the West-India Islands, near the level of the sea, is about 80°, and during the six months which include the winter season the temperature is only 2° lower. Now it will be readily admitted that few invalids are likely to be benefited by so high a temperature, more particularly when continued, almost without sensible variation, night and day. The extreme annual range in the West Indies does not exceed 20°, while the mean daily range throughout the year is only 6°. But it is not so much the actual degree of temperature of a tropical climate, as its unceasing and unvarying character, which oppresses and exhausts the invalid, more especially in cases where there exists a disposition to symptomatic fever.

[Moreover, it appears from the British Army Reports, that nearly twice as many cases of consumption originated among the British troops in the West Indies as at home: twelve per thousand of the aggregate strength of the troops serving in the West Indies being attacked annually, whilst of the Dragoon Guards, serving in Great Britain, the ratio is only 6½ per thousand. The disease, according to the same reports, is even of more frequent occurrence among the black than the white troops. (Sir James Clark, *op. cit.*, p. 303.)]

From this brief account of the climate of the West Indies, it is evidently an improper one, generally speaking, for consumptive invalids, who, nevertheless, are frequently sent thither. The uniformly high temperature, and almost cloudless skies which afford no shelter from the direct rays of a tropical sun, preclude invalids from taking exercise in the open air, the principal object for which they are generally sent abroad. There is no twilight to compensate for the heat and glare of the day, and the nights are too hot to admit of refreshing repose. When we add to the foregoing evils of climate the many privations, discomforts, and annoyances which are almost inseparable from a temporary residence in these islands, and the still more weighty objection derived from the experience of medical men who have resided there, we may consider the question of the propriety of sending patients labouring under consumption to the West Indies as finally set at rest. The concurrent testimony of all the medical men whom we have consulted on the subject, and whose opportunities of judging were ample, establishes the fact that consumptive cases sent thither from this country proceed much more rapidly to a fatal termination than in temperate climates.

Notwithstanding what has just been stated respecting the climate of the West Indies and its influence on consumption, we are not prepared to say that some, nay, many cases of deranged health, of a different nature, might not be benefited by passing a few of the less sultry months (from November to February) in that climate; more especially if the invalid possesses the means of enabling him to spend the greater part of his time on the water, merely visiting some of the more healthy islands occasionally. The remarkable revolution effected in the distribution of the circulating fluids, and the immense increase in the secretion from the cutaneous exhalents, excited and steadily maintained by a high atmospheric temperature, and this continued without intermission for many months, or even years, is unquestionably capable of producing material and very important changes in the animal economy, and may therefore be made a powerful agent in the cure of chronic diseases.

Calculous disorders are extremely rare in the West Indies, a circumstance which probably depends, in a great degree, on the abundance of the cutaneous secretion, by which the largest proportion of fluid is discharged from the system, and along with it some of those saline principles which constitute the chief ingredients of which urinary calculi are composed. A well known case has been recorded of an officer who was about to undergo the operation of lithotomy in this country: he was suddenly ordered to Jamaica, and after some time no calculus could be discovered in the bladder, nor were there any symptoms of the existence of one. Aneurisms and diseases of the heart and large vessels are also rare, and the osseous deposits, which are so generally found in the coats of the larger arteries in persons who die at an advanced age in cold climates, are said to be rarely met with in those who die at a similar age in the West Indies. Gout is not common, and rheumatism neither frequent nor severe.

Reasoning on the above facts, we should expect that the climate of the West Indies would prove serviceable to persons labouring under what has been denominated the calculous diathesis, in which there is a constant disposition to renal irritation, and the formation of gravel, upon any material change of the weather, or any trifling derangement of the digestive organs. The functions of the skin in such persons are generally imperfectly performed, and it is not unreasonable to believe that the powerful action excited, and unremittingly kept up for some months, in the cutaneous exhalents might effect a permanent change in the constitution, and if followed up by warm clothing, daily friction, and a proper diet, might entirely destroy the disposition to the formation of gravel. Upon the same principle this climate also promises benefit to persons in whom we have either positive, or strong presumptive evidence that ossific deposits are forming in the arterial system, and laying the foundation of aneurism or diseased heart. Reflecting on the powerful effect of a high temperature on the various secretions, we think it not improbable that the further progress of such a morbid process might be checked by a timely removal to the West Indies, or any similar climate, and a residence for a longer or shorter period there, according to the circumstances of the case. What has been already stated respecting the rare occurrence of calculous disorders and diseases of the arteries in this climate, affords some grounds for such a conjecture; and it may be adduced in further support of it, that *gout*, a disease intimately related in its nature and causes to both the preceding affections, is greatly relieved, and even entirely cured in many cases, by a change from a cold to a hot climate. This effect of climate has long been known. Van Swieten mentions the case of a gentleman who had almost entirely lost the use of his hands and feet from gout, and who, after a residence of nearly three years in the East Indies, returned perfectly free from disease, and continued so; and Haller relates the case of Lord de Poincy, who, when an old man, went to the warm American islands, and got rid of his gout and other infirmities. And such instances must have come under the observation of almost every physician.

Scrofula is a very rare disease in the West-India islands, and there are many cases of scrofula in this country which we have little doubt would be greatly benefited, if not cured, by a temporary residence in that climate. The cases in which we should expect the greatest benefit are those in which the disease exists chiefly in the lymphatic glands in torpid constitutions.

[United States.—For those of delicate lungs, it would appear, that *St. Augustine*, *Tampa Bay*, *Pensacola*, *Mobile*, and certain situations on the *Peninsula of Florida*, are the best situations, judging merely from meteorological registers; but, in all such cases, the extent of accommodation for the valetudinarian must be taken into account. The places on the eastern seaboard, especially, are exposed to frequent north-east storms, during which, however, the invalid must remain at home; yet there are few days during the winter when he cannot have the salutary revulsion which exercise in the open air is capable of effecting. Hence, any of these situations has a decided advantage over those of the northern and middle states. In the interior of *Georgia*, *Florida*, *Alabama*, or *Louisiana*, the same objections do not apply; and accordingly, they are often visited by the invalid during the winter, and with great advantage.

During the summer, the wide extent of this country affords great choice of residence. The *sulphur springs of Virginia*, especially the red sulphur; and the warm, the hot, and the sweet springs, are often frequented. These are situate high above the level of the sea, and afford as great a change as difference of climate can easily effect. During the summer, a tour may be made to any interesting region that is capable of exciting new impressions upon the mind; and, of late, favourable attention has been directed to the northern lakes as a summer residence for invalids of the south; and a tour to them may be of great advantage to those from every part of the country. (Prof. Drake, *The Northern Lakes, a Summer Residence for Invalids*. See also the writer's *Elements of Hygiène*, 2d edit. Philad. 1844.)

Southern Hemisphere.—The climates of the southern hemisphere are calculated to exert the same sanative agency on the frame as those of the northern. From their situation south of the equator, their seasons are the reverse of ours. August, September, and October, constitute the *spring* months; November, December, and January, *summer*; February, March, and April, *autumn*, and May, June, and July, *winter*.

Of the climate of certain portions of **South America**, we know something from the observations of the navy surgeons more especially. It rarely happens, however, that invalids are sent thither for change of climate. Dr. Burrough resided four years in *Lima*, and did not meet with a single unequivocal case of phthisis, which originated there during that period; although scrofula was not uncommon,—a fact which confirms the view of the distinctness of scrofulosis and tuberculosis. He stated to Dr. Morton, (*Illustrations of Pulmonary Consumption*, p. 159: Philad. 1834,) that he knew many foreigners in consumption to be much benefited by a residence in Lima; but that in every instance where they had been tempted to go farther south into *Chili*, the effect on their constitutions was fatal.

The **Cape of Good Hope** is occasionally resorted to by invalids from India and England.—From the Army Medical Reports it appears, that the climate is at least as favourable to health as that of Great Britain. The troops are less subject to diseases of the lungs at *Cape Town*, than in the other British colonies; and there is a smaller proportion of deaths from consumption than has been observed in our foreign stations, except the East Indies. Rheumatism is, however, very common. The places chiefly resorted to by invalids from India and England at the Cape of Good Hope, are *Rondebosch*, about five, and *Wynberg*, about eight miles from Cape Town; at both of which places there are good accommodations.

The climate of **Australia** is said to be remarkably healthy. Europeans, enervated by a residence in India, are very much invigorated by a short residence there. (Sir James Clark, *op. cit.* p. 336.)]

We have now noticed the principal climates, both in our own and foreign countries, which have acquired the greatest reputation as places of residence for invalids, and regarding which our information is sufficiently accurate to enable us to speak with much certainty. From a residence at one or other of these places, or at several of them in succession, all that climate can effect may, we believe, be obtained by the invalid whose disease admits of benefit from a change of this kind; provided always that the climate which is best suited to his disease and constitution be selected. In making this selection we must, in the present state of our knowledge, be guided chiefly by experience; for although an acquaintance with the physical characters of a climate is highly useful in enabling us to form a tolerably correct opinion respecting the diseases in which it will prove beneficial; still, until we have had some experience of its effects, we can never be sure that our conclusions are correct; so complex is the subject of climate, and so many are the circumstances, some having reference to the agent and others to the subject, which require to be taken into account.

We shall now state briefly the effects of climate on those diseases on which it has been found to exert the greatest influence.

Pulmonary Consumption is the disease in which, from its supposed dependence on climate, and its being found to resist all other modes of treatment, this remedy has been more particularly had recourse to, and almost as the only remaining hope. This is not the place to enter into a full detail of the circumstances under which climate promises benefit in that disease. (See the article Pulmonary Consumption.) We may, however, remark here, that climate, to be productive of real benefit, must be tried at a much earlier period in the progress of tubercular disease than it generally is. Such is the insidious manner in which consumption, in many cases, steals upon its victims, that it has too often stamped its indelible impression on the vital organs ere the alarm is sounded, or climate or any other effectual means of treatment, have been seriously thought of. Before we can reasonably hope to cure phthisis, we must take a much more comprehensive view of the pathology of that disease than we have hitherto done: in place of fixing our attention solely on the diseased state of the lungs, we must direct it to the morbid condition of the system,—to the tubercular cachexia in which phthisis has its origin. As regards the application of climate to the disease, it is not, we believe, saying too much, when we state that consumptive patients are, for the most part, sent abroad one year at least, often several years, too late to derive any essential benefit from change of climate.

During that peculiar state of deranged health which may often be observed to precede tubercular cachexia,[*] and during the existence of this morbid state of the constitution, before the disease has manifested itself in the actual development of tubercles in the lungs, change of climate forms a powerful adjunct to the other means best calculated for removing such a state of the system. When tubercles already exist in the lungs, the chances of cure are immeasurably lessened; but even then climate affords one of our most valuable resources, and one which promotes the salutary action of all our other remedies; and although our hopes of benefit under such a discouraging state of things must in general be faint, we believe the further progress of the disease may, in some cases, be thereby arrested. But such instances of success are no doubt very few, compared to the many which proceed unchecked in their course to a fatal termination, in despite of climate and every other means which we can oppose to their progress. We would therefore beg to impress upon the minds of our professional brethren the urgent necessity of directing their attention to the earliest indications of this disease, seeing how utterly inefficient all our efforts are even to stay its fatal career, when so far advanced as to manifest itself to the common observer. Until the tubercular affection of the lungs, which constitutes the essential character of what is commonly termed phthisis, is considered in its true character, as the last stage of a disease,—as the result of a morbid state of the system, which in its progress might often be cured, but which in this its termination is scarcely to be remedied,—we must still continue as heretofore, little better than idle spectators of the ravages of a disease which destroys one-fourth of our population, and numbers among its victims a large proportion of the best and fairest of our youth.

In proof of the correctness of our opinions respecting the influence of climate on phthisis in its early and late stages, we shall give the experience of Dr. Renton, an intelligent and observing physician, who has long practised at Madeira, and has had ample opportunities of watching the effects of that climate on phthisical invalids sent thither from this country.

This gentleman has favoured us with notes of the cases which came under his own particular observation. From these we find that between the years 1827 and 1830, *nineteen* patients labouring under confirmed phthisis arrived in Madeira, the whole of whom died; the greater number on the island, the remainder after returning to England. Of *thirty-three* cases of incipient phthisis, which arrived during the same period, *twenty-three* are now at home, (June, 1830,) apparently in good health; two remain in the island, one apparently well, the other considerably better since his arrival, but still in a doubtful state; two died, one in the island, and another after leaving it: the fate of the remaining six is not known. We consider this statement as a satisfactory reply to those who doubt and cavil respecting the influence of climate; their opinions being formed in general from a few cases sent abroad at a period of the disease when no hope of benefit could be reasonably entertained. It is only by such numerical records as the above, that we can expect to arrive at accurate conclusions respecting the influence of any means of cure in a disease, which will prove fatal in a very large proportion of cases, under any circumstances. The result in the first series of cases is nothing more than every one would expect who is acquainted with the nature of phthisis, and knows the state of the lungs in what generally passes under the name of confirmed consumption. But while Dr. Renton's experience of the effects of the climate of Madeira shows the inutility of change of climate in the advanced period of phthisis, it holds out considerable hopes from the adoption of this measure in its early stages: of *thirty-three* cases of incipient consumptions, *twenty-four* were apparently cured. Such a ratio of success, we have reason to believe, has never before been observed among consumptive invalids sent to Madeira, and for this plain reason—that they were rarely sent till the disease was too far advanced to admit of recovery. Dr. Renton remarks in his communication to us, "With respect to the invalids sent out, they have been very different for the last two or three years from those sent out formerly." We have the satisfaction of thinking that we have contributed, in some degree, to this favourable result, by our appeal to British physicians in the work already referred to; and we shall be happy to find that the striking proof of the truth of our former remarks, now recorded, induces our professional brethren to pay still more attention to this subject.

Of the Atlantic Islands, Madeira; in Italy, Rome and Pisa; and in England, Torquay and Undercliff, afford the best climates for consumptive cases. [Sir George Lefevre (*Thermal Comfort*, Amer. edit. p. 39: New York, 1844) recommends Valentia, in Spain. In the United States, St. Augustine, Savannah, Mobile and Pensacola, on the sea-board, are often visited; and occasionally the interior of the peninsula of Florida, Alabama or Louisiana.]

In stating these places to be the most favourable residences, we beg to be understood as referring to the winter chiefly. Italy, during the summer, is decidedly injurious to the phthisical invalid; and those who have passed the winter in the milder climates of England should in general seek a more bracing air in summer, such as that of Malvern, or even some of the more elevated and drier districts of our island; or, what would be still better, they might in the course of this season change from one place to another, taking care always that no place was visited possessing a climate decidedly hostile to their particular state of health. Such frequent changes of residence, when judiciously conducted, and combined with exercise on horseback, and a regimen suited to the particular state of the patient, are among the most effectual means which we possess for preventing consumption in persons predisposed to it, more especially in early life.

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[*] For an account of this affection see a work by the writer of this article, entitled "*The Influence of Climate,*" &c., p. 315, &c. 2d edit. Lond. 1830. 3d [edit. Lond. 1841.]

Chronic Bronchitis.—The morbid conditions of the mucous lining of the larynx, trachea, and bronchi are greatly influenced by climate, and the change from a cold and moist to a mild and dry air seldom fails to relieve, and occasionally removes them. The situations which have been mentioned as most favourable in phthisis are best suited also to bronchial diseases generally. Of the continental climates, those of Rome and Pisa are the most beneficial in cases attended with an irritable state of the affected parts without much secretion; and that of Nice in cases attended with less sensibility, a more copious expectoration, and a relaxed state of the system generally. Madeira, as far as our experience goes, has proved more beneficial in the former class of cases than in the latter. In England, Torquay and Undercliff afford the best climates in the first class of cases, and Clifton in the latter, in which Brighton also is a very favourable residence during the autumn.

Asthma is often greatly relieved and occasionally ceases under the influence of a mild climate, more especially when complicated with disease of the bronchial membrane, as it almost always is when of some duration. In what has been termed humoral asthma, Nice is the best residence; but Rome is preferable when this disease is accompanied with an irritated state of the digestive organs, a complication which is exceedingly common.

Chronic Rheumatism.—Climate produces the most decidedly beneficial effects in this disease, and that often with surprising rapidity, even in cases of long standing, which have resisted the best-directed medical treatment. We would particularize Rome and Nice as the best residences for invalids suffering from this complaint. The preference to be accorded to the one or the other place will depend upon the character of the patient's constitution and the state of his digestive organs. When there exists an irritable state of these, we have already remarked that the climate of Nice will generally disagree, whatever may be the more prominent disease. [Signal benefit is often derived, during the summer, from the Warm Spring and Hot Spring baths of Virginia.]

Gout is remarkably alleviated by a warm climate. In the selection of a residence for the gouty invalid, we must be guided by the particular state of his constitution, and the effects of the different climates which have been already pointed out. Genoa is rather remarkable for the rare occurrence of the disease among its inhabitants. But a warmer climate than any part of Italy would, in many cases, we have no doubt, prove still more effectual in removing gout. We have already remarked the effects of the West-Indian climate in this disease.

Scrofula.—Strumous affections, especially when seated in the skin and lymphatic glands, are frequently cured, and the general health is greatly improved, by a mild climate. In such cases Nice and Rome have appeared to us the most favourable residences; but in giving a preference to either, in this and all other complaints in which a residence in these places is useful, the practitioner must always keep in view the characteristic peculiarities of these climates formerly pointed out. There are cases of this disease in which the climate of the West Indies, as already remarked, would prove more effectual than any European climate; those, namely, of an indolent character with little disposition to febrile excitement.

Dyspepsia.—Different forms of dyspepsia, hypochondriasis, and other nervous affections, intimately connected with a disordered state of the digestive organs, all of which are aggravated by a cold and humid atmosphere, are much mitigated by a winter's residence in the south of Europe, if aided by proper regimen. Attention to the diet is particularly necessary in changing from a cold to a warm climate, and in no class of cases is this more requisite than in those of which we are now treating. (See DYSPEPSIA.)

The dyspeptic invalid from the north will require to be still more on his guard in the south of Europe than in his own country, particularly as regards the use of stimulants; but in nervous and hypochondriacal cases the state of the mind must always be taken into consideration in our selection of a climate and residence for the invalid. Unless we can produce an impression on the mind as well as the body, we shall make little progress in the cure of these affections. A change from one place to another will, generally speaking, be better than a long residence at any one; as much of the benefit obtained in such cases arises from a constant succession of new and agreeable impressions made upon the mind. A judicious and timely change of climate, combined with a considerable extent of travelling through a country and scenery which excite a lively interest, produces the best effects on the health of persons whose minds have been overstrained and exhausted by long-continued application to the same subjects, or whose general health has been destroyed by chronic dyspepsia, and the abuse of medicines, to which it too generally leads.

A single season properly spent in the south, more especially in Italy, is often productive of the most salutary effects in restoring the energy both of the mind and body; and if due attention is paid to regimen, especially as regards diet, the benefit derived will be both greater and more permanent than can be obtained, perhaps, from any other mode of treatment.

The morbid states of the mucous membranes generally are greatly benefited by a mild climate. We have already remarked its beneficial effects in the diseased conditions of the bronchial membrane, and that of the stomach, in dyspeptic affections. In similar states of the intestinal membrane, accompanied with chronic diarrhœa, a mild climate will contribute powerfully to restore the parts to a healthy state. Dysmenorrhœa, which is frequently dependent on irritation of the mucous membrane of the uterus, is often quite removed, and the healthy state of the whole uterine functions restored.

Irritable cutaneous diseases are also much alleviated by a residence in a warm climate.

It would be impossible, without extending this article to an undue length, to particularise all the disordered conditions of the system in which the change to a mild climate proves useful; but we must not omit to notice several distinct periods of life at which the beneficial effects of such a measure have appeared to us most striking, when from any cause the health has become deranged. The first is during childhood. From what has been said, in the early part of this article, of the operation of a mild climate on the various functions, it will be easily understood how beneficially this influence must be exerted at this early period of life, in favouring the growth and development of the system; and accordingly we have had abundant opportunities of observing the excellent effects produced on the health of delicate children by a residence of one or two winters in Italy.

When the health of children is naturally delicate, or when it has been rendered so by some of the diseases of childhood, such as measles, hooping-cough, scarlet fever, &c., no measure with which we are acquainted will prove so effectual in restoring the health as a change to a dry and warm climate.

Again, about the period of puberty, or a little before this time, a change to a southern climate for one or two winters is a measure which, if judiciously advised and carefully executed, will seldom fail to improve the general health of delicate persons, and favour the full development of the system which takes place at this period of life; and when there exists a disposition to tubercular disease, it will tend materially to obviate it. We beg however, to observe, that we speak of the effects of climate in those cases, not so much as a single remedial measure, as a measure which, while it contributes powerfully of itself to improve the health, favours the operation of a proper regimen, and such other remedies as the circumstances of the particular case may require.

The third period of human life at which we have remarked the powerful influence of a mild climate in ameliorating the health, occurs at a more advanced age. The two first occur while the body is yet in progress to maturity, the third when it has passed the zenith of its power. In the first instance, a mild climate enables a delicate frame to attain more certainly its full maturity; in the latter it prevents it from sinking prematurely into decrepitude, and enables it to prolong its existence until the period marked for its natural decay.

From about the age of fifty to that of sixty, though not unfrequently at a much earlier period, either when the system is naturally weak, or the causes of disease have been powerfully applied, the impaired condition of health now alluded to usually supervenes. This state is marked rather by anomalous disorder of various functions, indicative of a premature decay of the powers of life, than by any formal disease acknowledged in our systems of nosology. The activity of the mind and the bodily vigour have sunk many degrees, without any evident cause, and the individual, both in appearance and feeling, seems rapidly lapsing into premature old age and its accompanying infirmities. This disordered state of the health has been termed the *Climacteric Disease;* but, as we have already remarked, it occasionally occurs long before the period of life at which this change of the constitution is stated to occur naturally. (See Age.)

The causes which lead to this condition of the health are various; as, for instance, an anxious and sedentary life, long-continued and close mental application, or irregular and intemperate habits of living; and oftener still it is the consequence of the combined influence of several of these causes. From whatever cause it originates, a change for one or two years to a milder climate will prove of the greatest benefit in restoring the invalid to his wonted health.

Before closing this brief survey of climate, and of the various diseases benefited by it, there remains one circumstance to be noticed, and it is one of some importance to the invalid: we allude to the proper period for his returning to this country from the milder regions where he has been sojourning. Invalids finding a very sensible improvement in the state of their health, are too apt to consider themselves well, and become impatient to return home on the least feeling of inconvenience from the heat of the spring. Influenced by this or other causes, they frequently err by leaving a southern climate too early. A relapse of the disease, for the cure or relief of which they were sent abroad, is not unfrequently the consequence; and thus it often happens that by a little impatience, or imprudence, and occasionally from ignorance of the consequences, the advantages obtained by passing a whole winter in a mild climate are speedily destroyed. It should be the care of the medical adviser to warn his patient, before he leaves his own country, of the risk he runs by returning home too early. If his winter residence has been Italy, the invalid should avoid recrossing the Alps till the summer is fairly established in Switzerland. He may commence his journey northwards from his winter quarters in May, but should linger in the north of Italy, or among the Italian lakes, till he finds the heat inconvenient. This will seldom happen before the first or second week of June; and whatever may be his feelings in Italy, the period we have just mentioned will be sufficiently early to arrive in Switzerland. Independently of the risk of exposure to cold while crossing the Alps, which may, indeed, be avoided by proper clothing and arranging the day's journey so as to complete it before sun-set, the invalid will find a remarkable difference between the atmosphere of Switzerland and that of Italy. He will be particularly sensible of the keenness of the evenings and nights in Switzerland. Indeed, the scenery of these two countries does not differ more remarkably to the eye than does their climate to the feelings.

When the winter has been passed in Madeira, or any of the other Atlantic islands, and more particularly the West Indies, the invalid should be still more careful not to leave his quarters too early in the season. By a little care to avoid exposure to the sun, he may escape injury from the heat; but it will be difficult for him to guard against the pernicious effects of our cold north-east wind as he enters the Channel, or arrives on our shores.

A delicate invalid who has passed the winter in any southern climate, should endeavour to arrange his journey or voyage so as not to reach England before the middle or rather the end of June; and his warm clothing, which he may have laid aside, should be resumed the moment his feelings tell him that he is entering a colder and more variable climate.

[Invalids who have passed the winter in the West Indies, or in the southern part of the United States, should be especially careful not to return too early to their homes. The spring months are markedly those of great vicissitudes, and trying to the delicate. Dr. Jackson, of Boston, who sends his patients chiefly to Cuba, directs them to remain there until the last of April; then to go to Georgia or South Carolina, and to return to Boston very slowly, so as not to reach New England until the end of June; and the course is precautionary and wise. (Sir James Clark, *op. cit.* p. 306.) Should the invalid be unable to pursue this course, he ought to remain in his winter retreat until the end of May, if practicable.]

It is of the greatest consequence to invalids to maintain an active state of the circulation in the surface and extremities, which cannot be done in this country without the assistance of warm clothing. The increased circulation in the extreme vessels is one of the effects of a warm climate, from which the invalid derives the greatest advantage; and it should be his especial care to preserve it while in progress to and after his arrival in a colder, as to the steady maintenance of this for a considerable length of time he must mainly look for the preservation of his new stock of health.

In leaving his own country, therefore, in the early autumn, on his way to a warm climate, and in returning home in the succeeding spring, he should avoid exposure to great vicissitudes of temperature, and thus endeavour to secure the advantages, as it were, of several successive summers.

JAMES CLARK.

COLD.—It is designed under this head to treat of the morbid effects of excessive cold applied to the human body, and of the means of removing them; and also of the application of cold as a remedy in diseases.

The term *cold* is relative, and, perhaps, strictly speaking, ought to be restricted to that sensation which is produced in the animal body by the abstraction of caloric from it, in consequence of the application of any solid, fluid, or gas, of a lower temperature than itself. In common language, however, cold is spoken of as a positive agent, and by some men of science it has been supposed to have as distinct an existence as caloric, or the matter of heat. The result of some experiments instituted to demonstrate that cold may be radiated in the same way as caloric, appears to have confirmed this opinion in some minds; but the effects produced by those experiments are explicable on the supposition that caloric is radiated, and not an agent of an opposite character.

The sensation of cold is not always produced by the same degree of temperature, for it depends very much on the state of the body previous to its application; indeed, what may be considered a low temperature under some circumstances will cause the sensation of warmth, and a comparatively high temperature will produce that of cold. If the right hand be immersed in water at the temperature of 80° of Fah., and the left in an equal quantity of water at 40°, the former will receive the sensation of heat, and the latter that of cold; but if the two quantities of water be then mixed, and both hands dipped into the mixture at the same time, the feeling of cold will be produced in the right, and the feeling of warmth in the left; so that no fixed temperature can be called either hot or cold. The generation of animal heat, or, in other words, the internal development of caloric, is accomplished by a process continually going on in the body, more actively perhaps at some times than at others.

The abstraction of caloric from the body within given bounds may be regarded as a salutary process; on this circumstance the degree of vigour observable in the human frame, in temperate climates, so much greater than in either what are called the torrid or frozen regions, may in no small measure depend; the degree of abstraction being neither so great as to leave the system torpid, nor so slight as to render it oppressed. Instinct and reason have led to attempts to regulate, by various artificial means, this cooling effect of the surrounding atmosphere in cold climates and seasons, as well as by contrivances for cooling the air in hot regions, to protect the system against the effects of excessive heat; and it is a remarkable fact, that a provision in nature seems in some degree to be made to accomplish the same object in the animal kingdom; for in very cold climates wool and hair grow abundantly long and thick on the brutes, so as to protect them against cold, while in the hotter climates their skin is scarcely covered; and the same animal on being removed from a cold to a warm country, or from a warm to a cold one, is found to change the length of his coat. Thus dogs taken from England to India will often lose all their hair; and in our own climate the horse is well known to have the length of the hair covering his skin regulated by the clothing in the stable.

Perhaps the temperature of the atmosphere which is most congenial to the human body is a range between 55° and 70° of Fah.; but habit has much to do with this, as with almost every thing connected with the actions of the animal economy. An extreme degree of heat may be often endured without much inconvenience by those who have been long habituated to it; and the same may be said of cold. But when the system has been making an effort, if the expression may be used, to resist the bad effects of either a very low or high temperature, a great and sudden change in the surrounding atmosphere is always productive of inconvenience. This remark refers not to a change of climate only, but to the vicissitudes which may occur in the temperature of the atmosphere in the same climate. Persons who are strong and robust, however, feel less inconvenience from these sudden changes than those who are weakly; hence the importance of regulating the quantity of clothing according to the powers of the system, and especially according to the vigour with which the circulation of the blood is carried on. A very *frequent* exposure to changes of temperature will often enable the body to resist the ill effects of these changes, and affords another instance of the power of habit. The fact just mentioned is illustrated by the good health often enjoyed by those persons who attend large furnaces, glass-blowers, smelters, &c. The wonderful power of the body to accommodate itself to the circumstances under which it is placed, is, in this particular, exemplified in a very striking way. Hence, undoubtedly have originated the various modes of attempting to harden the system, and thus to prepare it to resist the morbific agency of cold. It is undoubtedly true that such means will often give tone to weakly persons, and prepare them for the vicissitudes of climate; but with such persons much care is requisite that the plan be not carried too hastily into effect. Indeed, it will be found that many cannot by any care be brought to bear it, and in such instances warm clothing must be mainly depended on as a defence from the sedative action of cold.

This leads to the more special consideration of the *morbid effects* produced on the human body by the *undue* degree of the abstraction of heat from it.

Caloric, or heat, as it is commonly termed, acts as a *stimulant* when applied to the animal body, its effects being local or general according to the extent and degree of its application: it increases, like most other stimulants, the action of the heart and blood-vessels; but (as is also the case generally with stimulants) a secondary effect occurs, which consists in a collapse, (or in an action lower than that which is natural,) after the excitement has subsided. Effects exactly the reverse of these take place from the abstraction of caloric, or, to use the common phrase, from the application of cold. Heat is therefore a stimulant, and cold a sedative, although the exact mode in which heat or cold acts on the body will probably never be determined.

The well-known immediate effects of a considerable abstraction of heat are — the sensation which is called *cold*, pallor of the skin—from the absence of blood in the capillary vessels; or a reddish blue colour especially of the hands, ears, nose, lips, from a delay of blood within the capillaries, so that it becomes venous; — a shrunken state of the skin, and a contraction of it around the small glands which are imbedded in it, and around the hairs, causing it to become rough, and to resemble the surface of a plucked goose; hence the technical term *cutis anserina*. The same state of the skin of the scalp often causes the hair to rise in some degree from the head, with a feeling of tightness; this is called *horripilatio*. The extremities of the body suffer first, as the fingers, toes, ears, nose, &c., *i. e.* the parts farthest from the heart. The fingers and toes become sensibly smaller, so that rings which fitted before fall from the fingers, and shoes drop from the feet for which they were not previously too large. The action of the heart becomes diminished in force, and sometimes also in frequency—the latter being most commonly the result of exposure to a very intense degree of cold; and not unfrequently the pulsations, although weak, become more frequent than natural. These symptoms, which may be considered the moderate effects of cold, will vary greatly as to their degree in different persons exposed to the same low temperature: indeed, to some persons the abstraction of heat by the cold air of a frosty day affords a grateful feeling, and to such it may be really salutary: this will be referred to when speaking of the therapeutical effects of cold. In all persons, however, a very *intense* degree of cold will produce unpleasant sedative effects; and in those who have been previously debilitated, the powers of the system are depressed to an alarming, and even sometimes to a fatal extent: indeed there are very few individuals who have such vigour as to be enabled to resist the consequences of exposure, without sufficient clothing, to the severity of the winter months in the frozen regions, or to the intense cold which is met with in passing over very high mountains. The vascular system is not alone affected by the agency of cold on the body, as is proved by the symptoms which occur in the more severe cases of exposure; the brain and nervous system generally being soon brought under its influence. Perhaps it may be with propriety supposed that the nervous system primarily receives every impression from external agents; and that cold, therefore, first acts on this system, the vascular system being only secondarily affected: this question need not be here discussed.

Numbness, or a want of the ordinary acuteness in the sense of touch, is a consequence of exposure to cold: this numbness is experienced by most persons in their fingers and toes on a very cold day, or after having been long immersed in cold water. It is worthy of remark, here, that in these individuals there appears to be something very peculiar as it respects the action of cold on their extremities; the blood appears to cease to flow altogether into the vessels of the fingers and toes, which look exactly (as the common expression implies) like those of a dead person; and so torpid do they become under these circumstances, that a pin can scarcely be felt when placed between the ends of two of the fingers, and the motions of the hand are regulated, not by the touch, as is usual, but entirely by the sight. This singular idiosyncrasy has never received a satisfactory explanation: it does not appear to arise from debility of the vascular system alone, for it is found in some who have no sign of such debility: probably it may depend, as all idiosyncrasies appear to do, on an original peculiarity of structure: it is found to prevail in individuals of the same family. The very great diminution (almost suspension) of sensibility in such cases may arise in some measure from a want of the necessary supply of blood to the extremities of the nerves; as it is an undoubted fact that their sensibility is greatly regulated in its degree by the quantity of blood circulating through the capillaries. It may also in part depend on the direct effect of the cold on the nerves themselves; but that this action on the nerves is not the only cause of the torpor is rendered probable, if not proved, by the fact, that if artificial warmth be applied so as to bring the fingers to their natural temperatime, the sensibility will not return until the circulation is restored.

The whole surface of the body becomes less sensible to the touch under the influence of a great degree of cold; and the sense of taste is sometimes blunted. But further, when a still greater effect is produced, the brain loses its energy, and an irresistible desire to sleep ensues. Here we may again observe that it is hardly possible to determine whether this is the direct result of the action of the cold as a sedative on the brain, or whether it depends on a want of the due supply of blood to that organ, on account of the diminished action of the heart. When this overpowering tendency to sleep has commenced, much danger is to be apprehended; for it has generally been found, when indulged, to be the precursor of death. The interesting account given by Captain Cook of the excursion of Dr. Solander and Sir Joseph Banks, with nine other individuals, over the hills of Terra del Fuego, affords a very strong illustration of this effect of cold. Dr. Solander, who had witnessed the torpor and death produced by severe cold while crossing over some of the mountainous districts of the north of Europe, thought it necessary to put his companions on their guard, and requested them to resist determinately the strong tendency to sleep which he expected some of them would feel; his words, quoted by Captain Cook, were, "Whoever sits down will sleep, and whoever sleeps will wake no more." The doctor was the first who began to experience the anticipated effect of the cold; and so irresistible was the inclination to sleep, even in him, that in spite of his judgment and fears he entreated his companions to allow him to lie down; they acted upon the knowledge he had afforded them for their own safety, and partly by entreaty and partly by force kept him for some time from indulging his destructive inclination; but at last, becoming themselves almost exhausted, they were obliged to leave him behind together with two black servants who had also become drowsy. Dr. Solander was, however, roused, although with the greatest difficulty, after having slept about five minutes only, and carried to a fire which some of the party had succeeded in kindling, and thus narrowly escaped death, although for a time he almost lost the power of his limbs. The two poor blacks perished.

Many examples of this extreme effect of cold will be found on record in the writings of travellers and historians. [See Copland, art. Cold, Dict. of Practical Medicine; Dunglison's *Elements of Hygiène*, 2d edit.: Philad. 1844; Guérard, art. Froid, *Dict. de Méd.*, xiii. 522: Paris, 1836; and Veiter & Michaelis, art. Kälte, in *Encyc. Wörterb. der Medicinisch. Wissenschaft.* xix. 271: Berlin, 1839.] The same effect is produced, to a certain extent, in this country in very severe winters. The celebrated traveller Dr. Edward Daniel Clarke, the late eloquent Professor of Mineralogy in the University of Cambridge, was on one occasion nearly losing his life by cold. Having performed divine service at a church near Cambridge in the afternoon of a very severely cold snowy Sunday, in the year 1818 or 1819, he mounted his horse for the purpose of returning home. Soon finding himself becoming very cold and sleepy, and knowing well the danger of giving way to sleep, he put the horse into a fast trot, hoping by that means to arouse himself from the alarming torpor which was coming over him: this means was unavailing; and then fearing that he should soon fall from his seat, he dismounted and determining to use every effort to resist sleep, put the bridle under his arm and walked as rapidly as he could. This, however, did not long succeed: the bridle dropped from his arm, his legs began to falter, and he was just sinking down upon the snow, to rise, probably, no more, when a gentleman who knew him came up to him in a gig, and rescued him from his perilous situation. This account was given to the writer of this article by Dr. Clarke himself the succeeding morning; he then felt languid and feverish, after having had a good deal of re-action during the night, but the effect soon passed off entirely.

The action of cold is probably, as has been already remarked, greater on those persons who have naturally a weak circulation, or who have become weak from any debilitating cause; and this last is the reason why those are very soon affected by it who have undergone much fatigue. A moist state of the skin from perspiration or damp clothing will also accelerate the effect of cold, by superadding to the direct effect of the cold air the further abstraction of caloric by evaporation. It is a curious but well-established fact, that when the mind is deeply engaged, the body is less affected by cold; and it is perhaps on this account that maniacs will often bear exposure to extreme cold without complaining.

When the body is warm, and the circulation vigorous, provided there be no perspiration on the skin, the bad effects of exposure to cold are less likely to be experienced. The common practice, therefore, of persons cooling themselves gradually before they pass from a warm room into the open air has originated in error: the greatest protection from the bad consequences of such a change is found in a vigorous circulation, a warm dry skin, and thick clothing.

Long-continued immersion of the body in cold water seems to be productive of nearly the same symptoms as those which arise from exposure to a very cold atmosphere. It has been asserted, on the ground of recorded facts, that less danger is likely to ensue from immersion in sea-water than in fresh water; and it has been alleged that this minor degree of effect is referrible to the stimulating quality afforded to the sea-water by the salts which are dissolved by it. This solution of the facts is probably in part correct; but it must be remembered that the water of the sea is rarely so cold in winter as that of rivers, the immense mass of the ocean requiring a much longer period than that of a winter to cool it down to the lower degrees of temperature of the winter atmosphere: there must besides, by means of the tides, be a continual admixture of the warm water from the southern seas with the colder water of the northern. A doubt, however, cannot be entertained of the advantage which persons who are exposed to the misfortune of shipwreck during severe cold will derive from keeping themselves immersed in the sea-water; and not only because the water is warmer than the atmosphere, but also because it will prevent the effects of evaporation. Many interesting accounts of shipwrecks have been published which show that this is not mere theory.

The complete and speedy destruction of life from exposure to intense cold may result from the general sedative effect which has been already described; but when life is not totally lost, the extremities may lose their vitality, and mortification to a greater or less extent ensue. Limbs are frequently in this way mutilated in cold seasons in northern latitudes, and in very high situations; when the surface of the nose and the ears suffers in this way, they are said to be frost-nipped or frost-bitten.

But the injury sustained from exposure to cold is not always dependent on its direct sedative action, for it may produce disease, and even cause death, by that secondary effect which is denominated *re-action*. This re-action after depression consists in the return of the action of the vascular system; if moderate, it may go little beyond the natural degree: the pulse becomes rather more frequent and full, and the heat of the surface greater than natural, and a glow is experienced over the whole body: this soon passes off, and leaves no evil consequences. But when the re-action is great, the vascular excitement is so increased beyond its due bounds as to constitute *fever*; and perhaps there may be in reality no difference between this state of the body and fever from other causes. The symptoms are often the same, and sometimes last as long; but the feverish state in a day or two will give way, in many cases, on using very mild remedies, or even without any remedies at all: such cases are called *ephemeral* fever.

Fever is not the only consequence to be feared from re-action after exposure to cold; local inflammation may follow this general re-action, and any of the internal membranes or organs may become the seat of the inflammation; but the particular organ affected in each case may be determined by some local predisposition: thus one person will have catarrh, another cynanche tonsillaris, a third pneumonia, as a consequence of exposure to cold.

It appears from what has been said, that it is to the excess of the re-action that such effects, both local and general, are to be attributed; and hence the importance of guarding against every circumstance which may have a tendency to stimulate the system immoderately after exposure to cold, and of employing measures calculated to subdue the action of the heart and blood-vessels when there is a threatening of sanguineous excitement. The danger of applying heat too rapidly is now generally known, as well as that of administering internally any strong stimulants. A person who has become seriously affected by cold should be placed in warm air about 65° or 70°, and should be well covered over with flannel to prevent the heat, as it becomes generated in the body, from passing off. Friction of the surface by means of the warm hands of two or three attendants, or with warm flannels, may be employed: in extreme cases the body may be wrapped in hot blankets until re-action commences; large hot poultices or fomentations may be applied with advantage to the abdomen; the warm air, vapour, or water bath, about the temperature of 98°, may be employed in those instances where the vital spark appears almost extinguished. The means already recommended must be combined with the employment of internal stimulants, alcohol, spices, ammonia, &c.: but it must be borne in mind that it is desirable to avoid the employment of internal stimulants to any great extent: indeed, to avoid them altogether if possible, as, after re-action has commenced, they, by their action on the system, may cause the injurious consequences of excessive excitement. If asphyxia (or a suspension of the action of the heart and lungs) succeed to the application of cold, artificial respiration, and the other means recommended in the treatment of asphyxia, may be required. When the heat and action of the system begin to return, care is especially necessary lest the excitement rise to an immoderate degree. The same principle must be our guide in attempting to prevent injurious consequences after the local effects of cold. Chilblains, which are a common consequence of the local application of cold, may be prevented by warming the parts affected very gradually, and by cooling them, as soon as re-action takes place, to the extent of producing the sensation called the *hot-ach*.

Large draughts of cold fluids, taken when the body is fatigued and perspiring, are often productive of serious or even fatal consequences: the effects are a faltering of the pulse, laborious breathing, dimness of sight, giddiness, and then general torpor and death. The proper mode of treating these cases has never been well pointed out; it appears, however, a rational practice to give, as soon as possible, some warm fluid, to apply hot fomentations or poultices to the epigastrium, and to resort to the means indicated by the principles already laid down.

The abstraction of caloric from the body may and is frequently made to conduce to the recovery of persons labouring under disease.

As a therapeutical agent, cold is employed to accomplish one of the three following purposes: —1st, to depress inordinate action of the vascular system; 2d, to relax the muscles; 3d, to give vigour to the body.

The sedative effect produced by cold has been already sufficiently dwelt upon to show how it may be employed beneficially to subdue high vascular action. In inflammation, therefore, and in fevers, cold may very often be considered as one of our most valuable remedies. It may be supposed by some persons, that the beneficial effect resulting from the employment of cold in inflammation and fever, arises from the simple diminution of the heat: indeed it is most probable that it was on occount of the augmented heat in those diseases that it was at first resorted to; but our present improved pathological views enable us to form a more correct judgment of the action of remedies; and there cannot now exist a doubt that the advantage arising from the use of cold in fever and inflammation is to be ascribed to its allaying vascular action.

When inflammation is situated in the external parts of the trunk of the body, or in the extremities, one of the means most commonly employed to subdue it is the application of an evaporating lotion. The lotion may be used cold, and then the heat is in some degree abstracted directly by the cold fluid; but the principal advantage (unless the lotion is constantly applied) is derived from the evaporation of the fluid. It is not, therefore, absolutely necessary that the lotion should be colder than the body of the patient, as evaporation will take place more speedily when it is tepid; and in some cases it is preferable to use it warm, on account of its being more agreeable to the feelings of the patient.

Although there cannot be a doubt entertained of the advantage of employing cold applications in cases of common inflammation of the surface and of the extremities of the body, yet by many it is held to be problematical whether they are properly employed in cases of internal inflammations, as of the membranes and organs included within the skull, the thorax, and the abdomen; as by such means the blood may be so thrown upon the internal parts as to aggravate the inflammation. As it respects the brain and its membranes, this reasoning, although at first sight plausible, is evidently fallacious. The object in cases of inflammation being to lessen the flow of blood to the part affected, any means which will control the action of the carotid arteries must be useful in inflammation within the head, as it is by those arteries that the greater part of the blood is conveyed thither. Cold applied to the scalp will be found to act as a sedative, not only upon the vessels of the integuments, but (by a sympathy which is well known to exist between the larger and the smaller vessels) upon the carotids also. It must be clear, therefore, even from theory, that cold applied to the integuments of the head will be of service in inflammatory diseases of the brain: but experience has long decided the point, and no practitioner omits this powerful remedy when he has to combat with such affections.

The immediate effect produced by a sudden dash of cold water, or by a stream of the same poured upon the face and head, is found useful in many states of the brain. This mode of using the remedy is sometimes adopted with advantage in phrenitis, in hysteria, in syncope, and in cases where narcotic poisons have been taken in large quantities, especially opium. The advantage may be owing in some degree, as in inflammation, to the sedative effect of the cold upon the blood-vessels; but this cannot account for the benefit produced in syncope, and the sudden impression made on the nerves by the cold must be also taken into the account.

It seems to remain doubtful whether or not cold may with advantage, or even with safety, be applied to the chest or abdomen when there exists inflammation of the membranes or viscera within those cavities. This practice has, however, of late been recommended by some physicians whose opinions ought to have weight, and especially so as the recommendation seems to be grounded on the result of experience: the limits of this article will not allow of a full examination of this interesting subject; the author, however, may be allowed to say, that in some cases of phthisis pulmonalis, where the pleura has become inflamed, an evaporating lotion, applied over the part in pain, has often appeared to be of considerable service.

Cold applied to the body has become a very common remedy in fever, when the system is in a state of very high excitement; and it is undoubtedly a remedy of almost unequalled efficacy in such cases. It may be employed by means of cold fluids received into the stomach, or by means of water or air applied to the surface. From the time of Hippocrates the powerful effects of cold have been appreciated in controlling febrile action; and it has from that period to the present time been occasionally lauded as an important therapeutical agent: but it was not until of late years that its applicability in cases of fever became fully understood. We are more especially indebted to the late Dr. Currie of Liverpool for our knowledge of the value of this refrigerant, and of the mode of employing it, (on the Effects of Water, &c. in Fever, London, 1805;) although very valuable information may be found scattered through other medical works. It is not in all cases of fever that this remedy can be employed with advantage, or even with safety: it is only calculated to subdue excessive action when that action is accompanied by a temperature of the body above 98°: even among such cases there may be a few in which some other peculiarity may forbid its use,—for example, when the skin is moist. At least, if it be employed under such circumstances, it will require the greatest caution, even although the temperature of the body be high, which, however, is very unusual when the skin perspires. In measles, cold is in no case to be applied to the skin, nor are cold fluids to be drunk. Nevertheless, in scarlet fever cold is of the greatest service in moderating the action of the system. It is probable, although not clearly proved, that where fever is accompanied by some visceral disease, this remedy may act injuriously, by determining a large quantity of blood to the internal parts of the body.

The circumstances which, when combined, may justify the employment of cold as a sedative in common fever, are an increase of the animal heat above 98° of Fahrenheit, a uniform increase of temperature over the *whole* body, and a dry state of the skin over the whole surface. If there be a tendency to perspiration, it will show itself first in a damp state of the palms of the hands, or of the axillæ. Should a sense of chilliness be felt by the patient, that also will render the employment of cold of doubtful propriety.

Several different modes of bringing the body under the influence of cold are resorted to by medical men.

First, immersion of the body in a cold or tepid bath.

Secondly, affusion of cold or tepid water over the body.

Thirdly, sponging the body with a cold or tepid fluid.

In some few cases, and in the very early stage of re-action, fever has been arrested in its progress by the cold bath or by cold affusion; but where fever is fairly established, it can rarely be suddenly put a stop to by these or by any other means: we can then only mitigate the severity of the symptoms, and thus give a better chance of the occurrence of a favourable crisis. But the practice of immersing the patient in a bath, or of throwing water over the body, has of late been very rarely adopted; and its disuse has not been without reason, for considerable inconvenience both to the patients and to the attendants is given, especially in private practice, by the employment of both these modes. But the principal objection to them arises from the impossibility of determining the precise extent to which we ought to carry the sedative effects of cold, while the body is immersed in the water, or while it is passing over it in the way of affusion. The patient may be kept too long or too short a time in the bath, or too little or too much water may be affused; so that the action of the system may be too much depressed, or not sufficiently overcome. These objections cannot be made to sponging the surface of the body with cold water: by this means the cooling process can be carried to the exact extent which is required; the criterion for judging of the effect being the feelings of the patient — a slight chilliness will mark the time to desist. Two or three attendants should be employed at the same time, with large wet sponges, passing them over the different parts of the naked body in succession, until the chill comes over the patient, who is then to be placed in a dry bed and moderately covered.

The temperature of the water when used with the sponges may not be a matter of much moment, as it is by means of the evaporation that the heat is principally abstracted from the body: tepid water (from 70° to 90°) will in general be found most agreeable to the feelings of the patient, and it will be equally, if not more speedily efficacious in reducing the morbid heat. It seems also probable, for reasons already assigned, that re-action will not so quickly occur after tepid as after cold sponging. When the desired effect is produced by this mode of refrigeration, the pulse becomes softer and slower, the skin cool and perspirable; headach, if before existing, is relieved, and frequently delirium is suspended, and the general feelings of the patient are so improved that sleep will follow. The remedy will, however, require repetition to derive from it its full advantage, and this should be as soon as re-action takes place to any extent; indeed the sponges may be used partially or generally many times in the day and night; but should the pulse rise very speedily, and the heat return very soon after it has been reduced by this remedy, other means must be combined with it, as bleeding, purging, &c.: but in by far the majority of cases of fever, dependence may be placed on refrigeration alone to keep down inordinate action. Vinegar, spirit, ether, &c., are sometimes used to increase the evaporation, but these are seldom required.

Cold air admitted into the patient's room, or a current of air passing over his body, will often tend to allay vascular excitement: hence poor patients, in fever, who have been lying in their own confined apartments, are often speedily benefited by removal to an hospital through the open air. It is very questionable if any medicine admitted into the stomach is worthy, strictly speaking, to be called a refrigerant, at least to be called so on account of any quality which it possesses, excepting its low degree of temperature, although many articles of the Materia Medica are reputed to have this effect; but on this point the reader is referred to the article REFRIGERANTS.

When hemorrhage occurs from increased action of the circulation, or is accompanied by such increased action, it may very frequently be restrained by the sedative effect of cold. The local application of cold to the bleeding vessels, or cold so applied as to act upon the large vessels which supply those which are bleeding, will be often found of very great service; for example, in hemorrhage from the nose (epistaxis), cold water used to the face and head will often of itself stop the flow of blood; but in cases of bleeding from the internal organs, cold, made to act upon the system generally, will often be found of great use in helping to restrain the action of the heart. A patient labouring under hemorrhage from the lungs (hæmoptysis), may with great advantage be kept uncomfortably cold: of course when the hemorrhage is not active, but of the passive character, injury rather than benefit might result from the employment of this means.

The depressing effect of cold upon the energies of the animal body is remarkably exemplified in the debility which is felt in the muscles of a person who has been long exposed to a very low temperature; indeed it is very probable that the sedative action of cold on the circulating system is to be ascribed to a diminution of the irritability of the muscular fibres of the heart and blood-vessels. When, therefore, an inordinate contraction of the muscles occurs, as in spasmodic diseases, the sedative quality of cold may cause them to relax when that remedy is applied to the body to a great extent. The cold bath and cold affusion have for this purpose been frequently employed in tetanus; the relaxation, however, which often occurs immediately after the application, is generally of very short duration, and it ought to be remarked that the sudden shock experienced on the first impression of the cold water will often excite an exacerbation of the spasm, and that immediate death has ensued in a few instances. This mode of treating the disease is certainly, in general, far from being effectual; and it cannot be deemed altogether a safe one. The sedative effect of cold on the muscles has been said to show itself in alleviating the irregular actions in chorea, hysteria, and other convulsive diseases; in these cases the cold bath or shower bath has been recommended. As an instance of the effect of cold in producing muscular relaxation, it may be stated that surgeons are sometimes able to reduce with great ease a dislocated limb during the temporary debility, which is induced in the muscles after long immersion in a cold bath. There are, however, other remedies capable of producing relaxation of the muscles, which must be considered much more certain than cold. (See the article ANTISPASMODICS.)

The last therapeutical agency of cold which remains to be considered, is its invigorating quality when employed in cases of debility, or, in other words, its *tonic* property.

It has already been remarked that the direct effect of a moderately cold atmosphere is grateful and refreshing to the feelings of some persons;

those who have naturally a very vigorous and too rapid a circulation, those who suffer from the production of too much animal heat, and those who are liable in warm weather to have an inordinate secretion from the skin, are generally benefited by the cold season of winter: by such persons, from their feelings, a cold frosty day will be called *bracing* and invigorating. To those individuals, however, who have a languid circulation, either naturally or as the effect of disease, cold weather is far from being either agreeable or beneficial. It has been found on inquiry that a severe winter is in this country, and especially in the metropolis, productive of more disease than a milder season; the old and the infirm being the chief sufferers, (*Bateman*, on the Diseases of London.)

An especial reference must here be made to the beneficial effects of that moderate degree of the re-action in weakly persons which follows the application of cold to the surface. The glow which pervades the body, arising from the increase of the circulation, is often at the moment accompanied by a sensible increase of vigour and activity. The benefit appears to depend very much on the blood being thrown in greater quantity into the capillary vessels, and on a consequent increase of their action in preserving the well-being of every part of the system. Cold, therefore, in this respect, seems to act indirectly as one of the diffusible stimulants. (See the article BATHING.)

Some kinds of diseases of the skin are benefited by cold or tepid bathing. When there is much inflammatory action of the cuticular vessels, it is desirable to avoid re-action, and this is best accomplished by the use of tepid water, (about 70°,) keeping the body a long time immersed, and afterwards preventing the skin from getting hot: in other cases, where an eruption seems to depend on a torpor of the cuticular vessels, it is desirable to favour the occurrence of re-action.

On the whole, the action of cold on the human body may be regarded as very important in a therapeutical point of view; it requires, however, as all remedies do, much judicious management; but with such management it is every day made the means of alleviating sufferings and of prolonging life.

JOHN WHITING.

COLIC, (*colica.*) This term, derived from κῶλον, *colon*, the name given to the large intestine, is in its medical application restricted to cases in which there is pain in the bowels, obstinate constipation, and generally vomiting, but without symptoms of pyrexia. The pain which accompanies enteritis and diarrhoea is denominated tormina, or griping.

Symptoms.—In cases of colic, although there be no tenderness at first, the attention of the patient is soon attracted by pain which is generally felt near the umbilicus and in the lower part of the abdomen, though sometimes over the whole belly. In most cases it is relieved by pressure, so that the patient endeavours to get relief by leaning upon his folded arms, or upon the edge of a bed, table, or chair; sometimes by lying with his weight upon the abdomen. The pain, however, may be increased on pressure. Dr. Abercrombie states that an intestine which has become rapidly distended is painful on pressure, though by attention the kind of pain can generally be distinguished from the acute tenderness of peritonitis. The pain, although constant, comes on in paroxysms, accompanied by a sense of twisting or wringing, especially about the navel. The abdomen is sometimes retracted, or drawn inwards; and occasionally the partial spasmodic action of the abdominal muscles gives an idea of the formation of balls or knots in the belly. In other instances the abdomen feels tense, elastic, and sonorous on percussion, from accumulation of flatus, which, after passing through the intestines with a rumbling noise, is expelled, temporary relief generally following its expulsion. These symptoms are usually from the first attended with vomiting, which is often so incessant, that whatever is taken into the stomach is sooner or later rejected; and in severe cases, from an inverted peristaltic action of the duodenum, the vomiting assumes a bilious character.

A variety of this disease, called *flatulent colic*, is very common in dyspeptic persons, more particularly in those who are ill nourished, or who are addicted to the use of spirits; and in children who are improperly fed, or whose bowels are disordered. In this form there is little sickness, and seldom constipation, but painful retention of flatus in the bowels, the colic depending principally upon debility of the muscular fibres of the intestines. Another very painful affection of a similar nature, which is not unfrequently mistaken for the effects of gall-stones, appears to depend on flatulent distention of the upper part of the intestinal canal—the duodenum and jejunum. In cases of this description, the pain is felt chiefly in the right hypochondrium, often extending to the back; and in consequence of the pressure on the ductus communis choledochus, where it perforates the duodenum, the flow of bile is interrupted: hence these attacks are often accompanied or succeeded by symptoms of jaundice. In such cases, on the subsidence of the pain, there is usually a perceptible movement of air in some part of the intestines, accompanied by a gurgling noise and discharge of flatus. The pain occasionally ceases entirely, but recurs at irregular intervals, varying from an hour to a day or two. This distention of the duodenum and jejunum is occasionally observed in dyspepsia, and in these cases bilious vomiting generally takes place.

When inverted action takes place throughout the greater part of the alimentary canal, not only the contents of the stomach and small intestines are discharged by vomiting, but those also of the large intestines. The vomiting is then termed stercoracéous, and such cases are denominated *ileus*, or the *ileac passion*.

The bowels, both in colic and ileus, are obstinately constipated; so that ordinary doses of aperients do not act.

At the commencement of the attack, the tongue is white, clammy, but soon acquires a thick coating or fur. The pulse is often natural, sometimes rather slow; but when the pain is excessive, or when the symptoms do not yield to the remedies adopted, it becomes quick, and the skin hot, indicating the threatening or supervention of inflammation of the bowels: hence the occurrence of febrile symptoms in colic should never be overlooked.

Several divisions of colic, founded on the supposed causes of the disease, have been proposed by systematic writers. Thus Cullen has enumerated no fewer than seven varieties. 1. *Colica spasmodica*, characterized by retraction of the umbilicus and spasm of the abdominal muscles. 2. *Colica stercorea*, arising from accumulation of the contents of the bowels. This form occurs in costive habits, and is speedily removed by active cathartics, which often expel an incredible quantity of fæces. 3. *Colica meconialis* is applied to the spasmodic pain of the bowels which infants suffer from retention of the meconium: it is evidently a modification of the last variety (stercorea). 4. *Colica accidentalis* implies the origin of the disease from acrid ingesta, and is frequently induced in individuals by particular articles of diet. 5. *Colica callosa*, in which there is a feeling of constriction ascribed to some fixed part of the intestines. 6. The *colica calculosa* arises from the formation and retention of intestinal calculi. And, 7. *Colica pictonum*, produced by the poisonous effect of lead on the system, which will be afterwards particularly considered.

All writers appear to agree in the opinion, that during the continuance of colic there is some cause which impedes or obstructs the passage of the alimentary contents. It is with reference to this obstructing cause that disputes among practical writers have arisen. The solution, however, of these discrepancies will be found in the fact that the symptoms of colic originate in a variety of causes. Cullen was of opinion that spasm was the essential cause of colic, and founded his varieties of the disease on the supposition that the spasm is the result of the operation of different agents on the muscular fibres of the alimentary canal. Dr. Abercrombie, on the other hand, attributes the symptoms of colic to a certain loss of the muscular power in a portion of the intestine, in consequence of which it does not act in concert with the other parts, but becomes distended by the impulse from the parts above, which in the healthy state would have excited it to contraction. He therefore infers that in colic the distended part is the real seat of the disease, and that the contracted part is not contracted by spasm, but merely collapsed, because it is empty, its muscular action being unimpaired.

It appears to us that the symptoms of colic may be referred to one of the following causes; spasm, obstruction, over-distension, inverted action. Although Dr. Abercrombie calls in question the possibility of spasm occurring in the muscular fibre of the intestines, he cannot be said to have proved this point; he has, however, made it clear that, in many instances where colic has been supposed to arise from spasmodic contraction of some part of the bowels, it ought to have been referred to another cause. It would require numerous facts to show that all muscular fibres are not occasionally liable to a state of spastic contraction; and it cannot be fairly doubted that, when irritating matters are passing through the bowels, such matters may cause an undue degree of contraction, so as to obstruct the passage of the contents of a portion of the tube which is above the point of contraction. We can in no other way explain the occasional production of colic from acrid ingesta. We know, however, that obstruction giving rise to colic, often arises from organic diseases, such as stricture in some portion of the intestine; various morbid growths in the intestinal canal diminishing its calibre; from hernial protrusion or internal herniæ; intussusception or invagination; twisting of the bowels, or a long band of organized lymph encircling them, forming a ligature. Colic also sometimes originates in adhesion between the adjoining portions of intestine, between the intestines and other viscera, or between the intestines and the parietes of the abdomen. Moreover, obstruction and a consequent attack of colic may arise from mechanical causes, such as collections of hardened fæces, calculous concretions formed in the intestines, large gall-stones, or hard substances which have been swallowed and become impacted in some part of the alimentary canal. Many of these latter causes may act in conjunction with spasm; indeed it is probable that spasm will, as Dr. Cullen supposes, often be induced by their presence, and that thus hard substances may be arrested in their progress downward by exciting a spasmodic action of the muscular fibres around them.

It is also plain, when any of the causes of obstruction just mentioned occur, that by the detension of the gaseous fluid, or solid contents of the bowels above the point of obstruction, over-distention of the intestines must ensue, the peristaltic action become inverted, or their muscular power altogether lost, as happens in an over-distended urinary bladder. It is an interesting subject of inquiry, whether, independently of any obstruction, the muscular power of any part of the intestines may sometimes become so paralyzed as to be incapable of propelling its contents onwards; and whether from this cause over-distension can take place to such a degree as to cause colic. Dr. Abercrombie, we have seen, has pronounced it to be his belief that the muscular action is entirely destroyed, the part which has been distended falling flat when it is emptied, and presenting a broad surface like an empty bag, without any tendency to contraction. He gives a case in which the patient lived for eighteen hours, with a free external opening directly communicating with the distended intestine, but without any discharge taking place, though the part contained only air and fluid fæces, and in which, notwithstanding the intestine for a considerable space above the opening must have been entirely deprived of its muscular action: on examination after death the part presented only a uniform distension, without any remarkable change either in colour or texture. Dr. Abercrombie therefore concludes that such want of power is the common, if not the constant cause of this disease. He gives also an interesting case, accompanied with painful local distension, in which, after resisting the most active purgatives, galvanism succeeded in procuring copious evacuations. Cases of colic are, no doubt, daily observed, which appear to arise from this cause; and it is probable that this debility of the muscular fibre produces, in many cases, the painful gaseous distension which often succeeds to enteritis or violent diarrhœa. Is it not probable that colic from the effects of lead is produced in this manner? Lead when applied externally does unquestionably destroy the tone of the muscular fibres of the limbs; and it would be a very remarkable circumstance, if the same agent caused paralysis in one part of the body and spasm in another. This species of colic, therefore, (*colica pictonum,*) may be adduced as a presumptive proof of the accuracy of Dr. Abercrombie's opinion, viz. that the symptoms of colic may require for their production nothing more than the loss of tone of the muscular fibres of some portion of the intestinal canal. In these cases the part of the intestinal tube which is affected will, from want of power, be incapable of propelling its contents onward; and thus by continuing to receive without being able to transmit them, the portion of intestine becomes more and more distended, and at length the whole tract above the point of the accumulation assumes an inverted action. Dr. Abercrombie thinks that this loss of tone in the muscular fibre may be caused by rheumatism; and as it is well known that colic often succeeds to exposure to cold, this theory is plausible.

In colic arising from spasm of some of the fibres of the muscular coat of the bowels, or by mechanical obstruction, the same distension and inverted action may take place; only in such cases they are the result of the obstruction, and not of the debility. It has been asserted by some writers, that an inverted action of the whole or of part of the alimentary canal, may be produced independently of either debility, spasm, or obstruction: they adduce, in proof of this opinion, the speedy discharge by the mouth of fluids which have been thrown into the bowels by clyster. These last are called cases of simple ileus, and perhaps the evidence adduced to prove the existence of such a state is still open to controversy.

Morbid Anatomy.—In the preceding account of the history of colic, it has been shown that the symptoms are dependent on a variety of causes, many of which are removable; but those cases in which the colic or ileus is merely symptomatic of incontrollable organic disease in the alimentary canal, are beyond the possibility of removal. Dr. Abercrombie, to whom the profession is so largely indebted for the record of many valuable cases and pathological deductions, states that ileus may be fatal without inflammation, and gives two cases in which a large part of the small intestine was found in a state of great and uniform distension, without any appearance of inflammation. In other instances, besides distension, lividity or incipient gangrene has been found, but without any appreciable change of texture: in some cases the usual inflammatory exudation was not observed; in others there was vivid redness, and in more advanced cases gangrene, with and without exudation of false membrane. Hence the usual progress of the disease in the fatal cases is into inflammation and its consequences—the inflammation varying from a recent tinge of redness to extensive gangrene; and it should be kept in view that these changes may be going on in a latent form with every variety of symptoms. Indeed we meet with cases in which inflammatory exudation has gone on to a considerable extent before death, yet in which there was neither frequency of pulse nor tenderness of abdomen.

Various kinds of mechanical obstruction have been found in fatal cases of ileus. The obstruction is occasionally connected with disease of the intestine, with hernial protrusions, with adhesions between two contiguous portions of intestine; so that, as in a case recorded by Dr. Abercrombie, a turn of intestine insinuates itself between the two adherent portions. Various forms of internal hernia, twisting of a portion of the bowel upon itself, intus-susception or invagination and calculous concretions (intestinal calculi), have also been discovered in fatal cases of ileus.

The symptoms of colic have been traced to various organic changes of structure, which diminish the caliber of the intestine. Under these are comprehended contraction or stricture of the bowel, which are situated less frequently in the small than in the large intestines; various morbid growths or tumours having their origin in the internal surface of the bowel, and which in their progress gradually diminish its diameter, till at length even liquids do not pass through the diseased or contracted portion.

The following observations of Dr. Abercrombie are valuable from the practical inferences to which they give rise. "From a review of the whole subject, it appears that there is a remarkable variety in the morbid appearances in those cases which are usually included under the term ileus. We have seen simple distension without any change of structure, and we have seen even extensive inflammation and gangrene. We have seen in several instances the distension apparently taking place at an early period, and gradually increasing through a protracted case, and then fatal, with little or no change in the texture of the part; and in others, we have seen at a very early period, and with much less distension, extensive inflammation, and gangrene. It would therefore appear probable, that in the cases which assume the character of ileus, there is great diversity in the primary state of the affected parts; that in some it consists of simple loss of muscular power, though it may pass into inflammation at an advanced period; while in others it is at an early period connected with inflammation as a part of the primary disease. These cases seem to differ from enteritis in their symptoms chiefly by the absence of fever; and in the morbid appearances, by being fatal with simple gangrene, uncombined with the flocculent or pseudo-membranous deposition, which is so prominent a character of enteritis. Now gangrene in the intestinal canal appears to be chiefly a disease of the muscular coat. A state resembling it is indeed observed occasionally in the mucous membrane; but the cases in which this occurs are accurately distinguished by their own peculiar symptoms, and they do not affect this part of the inquiry. When, in the cases now under consideration, therefore, we find gangrene uncombined with any other morbid appearance, we are perhaps warranted to conjecture that the muscular coat has been the principal seat of the inflammation. It seems to constitute a modification of disease of much practical importance, quite distinct from enteritis, and assuming simply the characters of ileus; but a modification of ileus of the most formidable kind, and very rapidly fatal. We shall afterwards see reason to believe that inflammation may be seated in the peritoneal coat alone, producing a disease which may be fatal without any interruption of the action of the canal, or that it may affect the peritoneal and muscular coat at once, giving rise to the disease which we commonly call enteritis." (Pathological and Practical Researches on Diseases of the Stomach and Intestinal Canal, p. 140.)

Diagnosis.—It is necessary to distinguish colic—1. from enteritis; 2. from hernia; 3. from obstinate vomiting, sympathetic of disease in some distant part.

The absence of fever, the pain being generally relieved by pressure, the aspect of the countenance, and the quiet soft pulse, will generally distinguish colic from enteritis. It is however never to be lost sight of, that enteritis may not only exist, but may be preceding to a fatal termination without frequency of the pulse or abdominal tenderness. On the other hand, there may be abdominal tenderness from simple distension of a portion of the intestine, but without inflammation. The stage of the disease must also be taken into consideration; though in the primary there may be no inflammation, in the more advanced stage it may supervene, and thus prove fatal.

When the symptoms of colic arise from a hernia, the protrusion will generally lead to its detection; besides, there is no pain in the beginning at least, and when it does occur, it is more circumscribed, and the tenderness does not extend over the abdomen until the hernia has existed some time, and has become strangulated.

There are many diseases accompanied by sympathetic vomiting, which may, without sufficient care, be confounded with colic. The sympathetic vomiting may arise from renal or biliary calculi, but in these cases there are some local signs of the origin of the affection; in the former case, pain of the back, and along the groins to the testicle and thigh, and disorder of the urinary functions; and in the latter, a greater disturbance of the functions of the liver, together with pain chiefly felt in the situation of the gall-ducts; besides, in neither of these diseases is there the same obstinate constipation of the bowels as in colic.

[In the form of colic, generally termed 'bilious,' a vitiated condition of the bile has commonly been considered the cause; but in the mass of cases this is certainly a secondary result. The disease consists, essentially, in great impressibility of the nerves of the digestive tube, under which a neuropathic condition is induced: this extends to the liver, which, under the erethism, increases its secretion; and, in like manner, an increase, and a morbid condition of the different intestinal secretions are occasioned. In this form of colic, prior to the appearance of the characteristic symptoms, the patient usually suffers under symptoms of disordered stomach and intestines, bitter taste, yellow fur on the tongue, nausea, vomiting, &c. When the colic occurs, the pain is excessively severe, cutting and screwing. The thirst is great, and anxiety and restlessness are attendants. After a while, bilious vomiting supervenes, and the bowels, which had been previously confined, or with scanty discharges, are evacuated freely—the fæces being largely mixed with bile. The symptoms then gradually abate, and terminate in entire restoration to health. Very frequently, the disease is attended with fever, and the severest forms are apt to end in inflammation of the intestines and death. (*Practice of Medicine*, 2d edit. i. 169: Philad. 1844.)]

Prognosis.—The prognosis in this disease must depend principally on the nature of the exciting cause. When it arises from acrid ingesta, such offensive matters will generally pass spontaneously or by proper treatment, and thus the symptoms will cease. When, however, hernia, intus-susceptio, stricture, or organic disease, produce an obstruction, of course the danger is in proportion to the hazard arising from the disease on which the colic depends; the symptoms of colic, in such instances, being entirely symptomatic of the primary affection. But, as we have seen, it is by no means an easy task, nay, often impossible, to distinguish the cases originating in such obstructions from those which are less dangerous; and the prognosis should therefore not be formed hastily in any case.

It has been observed by Dr. Abercrombie, that ileus has been fatal while the contents of the bowels were of a natural appearance; and when obstruction has existed, its entire removal has not been followed by corresponding relief of the symptoms.

Treatment.—We have seen that colic may depend on causes which are capable of removal, as well as on incurable organic disease: and the symptoms in both classes of cases being nearly similar, it is impossible to ascertain whether or not the colic depend on causes capable of being removed: we must proceed on the supposition that the disease is still capable of being controlled. It is always, however, a necessary precaution to ascertain that the symptoms do not arise from hernial protrusion, as it has not unfrequently happened that hernia, which has been the cause of the symptoms, has been overlooked, and the life of the patient thus exposed to danger. When the practitioner is satisfied that there is no hernial protrusion, or that there is no evident external cause to account for the symptoms, it will be a safe practical rule in all cases of obstinate colic, more particularly if the pulse rise and there be tenderness of the belly, and the powers of the patient do not forbid it, to abstract blood, both with the view of anticipating inflammation, or subduing that which is to be apprehended, and as a powerful means of procuring the evacuation of the bowels; the syncope, which generally follows bloodletting, especially if performed when the patient is placed in the upright posture, being often accompanied with this effect. The bloodletting may therefore be carried to this extent in all cases where the patient is vigorous, and even repeated if the state of the pulse and other symptoms require it.

In persons who are weak, and in elderly people, however, due consideration must be given as to the expediency of bloodletting. In such cases the topical abstraction of blood may be more advisable.

It is a matter of nice practical inquiry, how far the intestines should be stimulated by purgatives: on this point Dr. Abercrombie truly observes that the adaptation of the remedies to the individual cases demands the utmost discretion: it is impossible to lay down any general rules. There are some cases which yield at first to a powerful purgative, and there are others in which an active purgative is decidedly injurious. [Dunglison's *Practice of Medicine*, 2d edit. i. 163: Philad. 1844.] With these sentiments our individual experience leads us to concur, as well as with the plan of administering, at short intervals, moderate doses of mild aperients. Sometimes large doses of calomel, eight, ten, or even twenty grains, will remain on the stomach, and in the course of a short time move the bowels; in other instances very small doses of purgatives in combination, and frequently repeated, answer this purpose. Purgatives will often operate best when combined with sedatives, and this is explained by the effect of the sedative taking off resistance by allaying undue contraction in the muscular fibres of the intestines, while the purgative excites the general peristaltic action, and increases the secretions from the mucous membrane. Calomel combined with opium may be given with advantage every second hour for three or four times, and then a full dose of castor oil. If the oil be rejected by vomiting, it may be repeated with the addition of twenty or thirty drops of laudanum, and an enema, containing castor oil and laudanum, be administered to assist the operation of the aperient. In some cases attended with most obstinate vomiting, we have seen a drop of croton oil rubbed on the tongue, and repeated six, eight, or ten times, at intervals of half an hour, procure solution of the bowels when every other purgative had been rejected as soon as it had reached the stomach.

While we endeavour to act on the bowels by aperient medicines given by the mouth, and also in cases in which they are at once rejected, it is expedient to stimulate the colon by injections: these may consist of a combination of various purgatives in common use—infusion of senna, to which may be added neutral salts, cathartic extract, croton oil, turpentine, &c. The forcible injection of a large quantity (five or six pints) of warm water, in which soap has been dissolved, has proved successful. The tobacco glyster has been administered when the ordinary remedies have failed. It should be exhibited with much caution. Dr. Abercrombie recommends that the enema should be made by *infusing* fifteen grains of tobacco in six ounces of boiling water for ten minutes. If no effect has been produced by this injection after the lapse of an hour, it may be repeated in the strength of one scruple to the same quantity of water; and so on, until such effects are produced (slight giddiness, muscular relaxation, &c.) as show that its peculiar action on the system is taking place. It may then be repeated at intervals of one or two hours, if the case do not speedily yield. With these precautions he states that he has seldom seen any unpleasant effect from the free use of this powerful remedy. He adds, if while the tobacco injection is used in this manner, mild purgatives, such as aloes and hyoscyamus, are repeated in full doses every hour or two, the treatment is perhaps that which is most generally adapted to the ordinary cases of ileus, with the assistance of one or two bleedings if the symptoms require it, and especially if the patient be of a full habit. Opiates are very often useful in colic to allay pain. After a full bleeding, when there is tenderness, the administration of a full dose of opium, combined with an aperient, or thrown into the rectum by glyster, is often followed by relief of the pain, and evacuation of the bowels. Still, however, from the tendency of opium to diminish secretion and to suspend the peristaltic motion of the intestines, it should not be indiscriminately prescribed, but only when there are paroxysms of severe tormina. In these cases it should either be combined with a purgative, or, if given alone, it should be followed by some aperients.

There are other measures which should be put in force: the warm bath; hot fomentations, to which laudanum may be added: large blisters or oil of turpentine may also be applied to the abdomen.

When the means recommended have failed, some physicians have advised the administration of crude quicksilver in doses of one or two pounds. Sometimes the sudden dashing of cold water on the extremities, and the application of cold to the belly, have afforded relief by procuring evacuation of the bowels. These are severe measures, and are only to be adopted when the disease has resisted every other plan of treatment.

In cases in which the colic depends on incurable organic disease, all measures are alike unsuccessful. The patient is generally, under such circumstances, speedily relieved of his sufferings by death; though in some instances life is protracted for an uncertain period, during which the unhappy victim endures the greatest agony. The only resource left is palliation by narcotics, and other means calculated to soothe the sufferings.

[In bilious colic, the great indications of treatment are, *first*, to remove the spasmodic condition of the canal; *secondly*, to evacuate morbid secretions; and *thirdly*, to prevent the occurrence of inflammation. In plethoric and active habits, bleeding may be prescribed, with frictions and stimulating cataplasms to the abdomen; glysters of soap and water with laudanum or spirit of turpentine may be thrown into the colon; and should these remedies not be effective, full doses of opiates may be given by the mouth or rectum, until relief is obtained. Should there be danger of the supervention of inflammation, blood may be taken from the arm, or leeches may be applied to the abdomen, followed by the application of a warm cataplasm; with mild cathartics, as castor oil and laudanum, aided, if necessary, by emollient or anodyne enemata.]

JOHN WHITING.—A. TWEEDIE.

COLICA PICTONUM.—This form of colic is generally traceable to the action of lead upon the body, and is so called from its occurrence as an epidemic at Poictou. It has also received the names *Devonshire colic*, *painters' colic*, *plumbers' colic*. It seems probable, from both fact and analogy, that this metal produces a specific disturbance of the animal economy, of which disturbance the symptoms of colic are only a manifestation, so far as the alimentary canal partakes of the disorder. This agent, however, may produce a local disease, the effect of its morbific agency showing itself more strongly in the part to which it is immediately applied. Persons who are employed in lead manufactories, or in smelting ores which contain lead, painters, who use much white lead, and plumbers are more particularly the subjects of this disease; but it occasionally happens to patients who are employing some of the preparations of this metal for the cure of disease. Moreover this form of colic has occurred epidemically, and has been (as in the case at Poictou) supposed to arise from the employment of the acetate of lead in clarifying wine, cider, and other liquors. (See the papers of Sir George Baker in the Transactions of the College of Physicians of London.)

[The principal marks of lead cachexia are said to be—a peculiar bluish or bluish-grey tinge of the gums, which sometimes extends over the mucous membrane of the mouth generally, and which has been regarded by Dr. Burton (Watson's *Lectures on the Principles and Practice of Physic*, Amer. edit. p. 712 : Philad. 1844) as an infallible proof of the presence of lead oxide in the system ; the teeth at the same time become discoloured, and affected with caries : there is a sweetish, styptic, astringent taste in the mouth, with a peculiar fœtor of the breath ; sallowness of the skin, and dull yellow tinge of the conjunctiva, general emaciation, soft, small, compressible pulse, and in rare cases, a considerable reduction in the number of its beats. Of these symptoms, the discoloration of the gums and teeth is most frequent, and most characteristic, and it is considered to be owing to the deposition of a very minute film of sulphuret of lead on the mucous surface, and on the enamel of the teeth. It is important to attend to these premonitions, for of 1217 cases of lead colic observed by M. Tanquerel des Planches, (*Traité des Maladies de Plomb* : Paris, 1839,) 1195 were previously affected with one or more of them ; and in many instances, by attending to these premonitions, with temporary cessation from work, the threatened attack of lead colic was prevented.]

This affection has more largely fallen under the observation of those physicians on the continent residing where it prevails endemically. M. Ranque, Physician to the Hôtel Dieu at Orleans, has given a clear account of it, as it occurred between the years 1820 and 1826, among the persons who are employed in the white-lead manufactories at Orleans; and from this physician's account the author is induced to lay before his readers the symptoms of the disease. At first the patient loses his appetite ; he feels sick, with increased discharge of saliva from the mouth ; there is disturbance in the nervous system, and his nights are restless. He then vomits and discharges every thing he has swallowed, mixed with bile and morbid secretions ; to this succeeds pain in the abdomen, which is at first not constant, but returns at intervals, these intervals being longest at the commencement of the disease. The pain is severe about the navel, the epigastrium, the hypochondrium, the loins, and above the crest of the ileum. As the disease advances, the pain is almost constant, but is usually most severe at night, and is not increased by pressure. The abdomen is generally flat, but sometimes feels as if knotted, in other cases more or less distended. The disease is now attended with headach, pain of the limbs, especially of the inside of the thighs, knees, calves of the legs, ancles, and soles of the feet. There is no fever ; the pulse, indeed, is often below 60 in a minute. Constipation of the bowels is an invariable symptom, although it does not always occur at the very commencement ; the bowels are excessively obstinate, and when fæces are discharged, they are dry and lumpy. The appearance of the urine is generally natural. The expression of the patient's countenance indicates distress, and there is great prostration. Symptoms of inflammation of the peritoneum occur now and then at an advanced stage of the disease, indicated by tenderness of the abdomen, frequent hard pulse, and other febrile symptoms ; and in some rare instances the cerebral functions are disturbed.

The pain of the limbs is sometimes very speedily succeeded by paralysis, but it is more frequently after the severer symptoms have passed away that the extremities become so affected.

[The disease, in the large mass of cases, terminates favourably. Of 500 cases, treated at La Charité, in Paris, only 5 had a fatal issue ; and in 3569 collected cases, there were only 95 deaths, or about 1 in 30.]

The appearances presented by dissection after death throw but little light on the nature of colica pictonum. Inflammation of any of the textures appears to be only accidental, and is probably the effect, when it occurs, of the strong purges which are often used, or of the distension of the bowels, which is usually, if not invariably discovered. It is particularly mentioned by those who have had opportunities of inspecting the bodies of persons who have died from the effects of lead, that the bowels appear remarkably pale, as if the quantity of the blood in the vessels was less than usual. As has just been remarked, the intestines are often greatly distended in some parts, but in others they are contracted. Whether this contraction is the consequence of spasm, or (as Dr. Abercrombie would say) only the natural state of the tube when empty, it is not easy to determine ; and this uncertainty about the cause of the contraction renders it very doubtful whether the distension is the consequence of spasmodic obstruction, or the effect of debility or paralysis ; but as we know that the action of lead on other muscular fibres of the body is to destroy their tone, it is the most probable conjecture that those of the intestinal canal, when affected by this poison, cease to be able to propel their contents forward, and that in this way distension takes place.

The foregoing history renders it clear that the action of lead upon the system is very general ; and it also seems calculated to lead to the opinion that the symptoms arise from changes in the intestines, analogous to those which are produced in other parts of the body. The primary impression made by this metallic poison is probably upon the nervous system, which secondarily causes a change in the blood-vessels and the muscular fibres. Upon the muscular and vascular system it seems to act as a powerful sedative. It is probable that it is on account of its sedative action on the capillary system that lead is found useful in some cases of hemorrhage and inflammation—

may it not be from this same action upon the capillaries that the muscles become paralysed? It is a well-known fact that without a due supply of blood to their texture, the muscles lose their tone. The shrunk wasted state, and the blanched appearance of the muscles of persons who have died after having been paralytic from lead, seem to favour this opinion. In explanation of the primary action of lead upon the nervous system, it is difficult to form a reasonable conjecture. The acute pains which are felt at the commencement of the disease in different parts of the body, forbid the supposition that it acts as a sedative upon the nerves; and the fact that the sentient nerves of the limbs, when the muscles are paralysed by lead, remain as sensitive as in health, favours the same conclusion.

It may here with propriety be observed, that after the first severe symptoms of colica pictonum have been removed by free evacuations from the bowels, there remains usually great torpor of the alimentary canal, and that it is probable that this torpor is the result of a paralytic condition, more or less complete, of the muscular fibres which produce the peristaltic action of the canal.

Treatment.—The remarks on the nature of the disease tend to show that the treatment of colic arising from the poisonous effects of lead must be regulated by nearly the same indications as those which have been recommended for the treatment of colic from other causes. The object is, first, to procure a full discharge of the alvine contents, and afterwards to restore the bowels to their healthy condition. Purgatives, combined with sedatives, seem well calculated to fulfil the first intention; and no combination is better adapted than that of calomel and opium in the proportions already recommended. After a few doses, a large dose of castor oil, or a drop or two of croton oil may be given; enemata also will be found valuable auxiliaries; they should be administered about the time the purgatives may be expected to begin to act. The warm bath, the tobacco enema, and the other measures suggested as useful occasionally in the cure of colic, may here also be employed; and should there occur tenderness of the abdomen, or any of the signs of inflammation, bleeding from the arm or by leeches will be required. Emetics are employed largely on the continent. At the Hospital La Charité, at Paris, a very complicated plan of cure is adopted, but which, when analyzed, seems to be analogous to that which has been recommended in this article, although strangely pursued: it consists of emetics, cathartics, enemata, diluents, and anodynes. (See M. Andral on Abdominal Diseases.) M. Ranque, in the memoir already alluded to, recommends, on the ground of extensive evidence of its efficacy, the employment of strong counter-irritation to the abdomen and back by means of a plaster which contains cantharides and tartar emetic; and he also prescribes a liniment, made with some convenient vehicle, containing the extract of belladonna, to be rubbed on every part where pain is felt; he uses also belladonna in clysters; and the same sedative by the stomach, in the form of an ethereal tincture, (℥i. of the powdered leaves to f.℥iii. of sulph. ether, of which twenty drops is the dose.) The only peculiarity in this method of cure is the counter-irritation, which may probably with advantage be added to the list of curative means.

If the opinion be correct that lead acts as a powerful sedative upon the blood-vessels, no measure can appear better calculated to meet this morbific effect than powerful irritants. It is a fact well established that the paralysis which results from lead is most effectually treated by the use of blisters or other stimulating applications to the parts affected; and may we not, on the same principle, (through the medium of the sympathy which is so obviously maintained between the surface and the parts contained within the abdomen,) hope to rouse the activity of the circulation of the intestinal canal by strong irritants applied to the skin? When the first urgent symptoms are overcome, and the bowels have been made to act, great attention will be required to restore completely the tone of the digestive powers. Besides those means which have been enumerated as applicable during convalescence from common colic, astringents and stimulants seem particularly serviceable when a patient is recovering from colica pictonum. Alum in doses of ℈i. with a few grains of ginger or capsicum, may be taken with decided advantage two or three times a-day, with an occasional aloetic purge. The desideratum in this stage of the ailment is to restore the tone of the weakened bowel; and this will be most probably obtained by the combined effects of external and internal stimulants and astringents, wholesome and nutritious food, and a free state of the alimentary canal.

[Of late years, alum (gr. xv. to ʒij. every four or five hours) has been highly extolled, as well as sulphuric acid lemonade. M. Gendrin (Videcoq, art. *Colique*, in *Dict. des Études Médicales*, Paris, 1830) affirms, that he has cured more than 300 cases, by administering daily from a drachm to a drachm and a half of sulphuric acid, diluted in three or four pints of water. The cure was effected in three or four days. The experience of Gendrin has been corroborated by other observers; but others, again, have not been so fortunate. (See the writer's *Practice of Medicine*, edit. cit. i. 169.)

It has been elsewhere shown (Art. ARTISANS, DISEASES OF, p. 175,) that sulphuric acid is largely used in many lead works and laboratories, and with great success, as a prophylactic.]

The *dry belly-ach* of the West Indies is a disease of nearly the same description as the colica pictonum, and so is the *colic of Madrid*, mentioned by Dr. Pascal, (Mém. de Méd. et Chirurg. Milit. 1826.) Dr. Musgrave, of Antigua, has, in the Medical Repository, 1825, given a very good account of the former of these two diseases which is so very common among the negroes of the West India islands. He attributes the complaint to a morbid condition of the liver; but, in the estimation of the writer of this article, without sufficient evidence. The condition of the alimentary canal, which has already been pointed out, and especially that portion of it, the duodenum, which receives the gall-ducts, seems sufficient to explain the disturbance of the biliary function which he describes. In the West Indies the disease is attributed to the new rum which is drunk by the slaves. Dr. Musgrave depends principally on mercury for the cure of this complaint, and carries it to salivation, assisted by bleeding and purgatives. It is evident that this gentleman is influenced in his plan of treatment by the pathological views he entertains of the disorder; and it is a question which no one is better qualified, by talent and opportunities, than himself to decide, whether the cure may not be accomplished by mercury more sparingly administered.

John Whiting.

[COLITIS. (See Dysentery.)

COLON, DISEASES OF THE. (See Constipation and Enteritis.)

COLON, TORPOR OF THE. This disease is the source of anomalous symptoms, and, although generally the result of other morbid conditions, is worthy of a distinct mention. Many pathological phenomena, commonly referred to the heart and stomach, unquestionably acknowledge for their cause this affection.

Diagnosis.—Torpor of the colon is thus defined by Dr. Copland, (*Dictionary of Practical Medicine*, Art. Colon, Torpor of the)—"General debility, with indigestion; slow or irregular state of the bowels; distension, borborygmi, or stridulous noises in the course of the colon; frequently pain or uneasiness, sometimes with tumours in some part of this viscus."

Causes.—Torpor of the intestine may be owing, at times, to defective action of the system generally, and of the colon in particular; but not unfrequently it appears to be dependent upon narrowness of the canal, which occasions a dilatation of the intestine above the narrow portion, in which fæces or air may accumulate, and give rise to all the phenomena of ileus; or by pressure interfere with the functions of neighbouring organs. Occasionally, hard tumours, painful on pressure, exist in the colon, especially in the ascending portion. The writer has attended many cases in which various evidences of indigestion were present, with irregularity in the alvine evacuations; generally, constipation alternating with diarrhœa; great irregularity of the heart's action; often intermission of the pulse; giddiness, apparently from modified circulation in the encephalon; and undefinable uneasiness referable to the stomach and bowels, which is often relieved by a moderate dinner, so that the after part of the day may be passed in comparative comfort.

Treatment.—This must vary with the cause, where it is appreciable. When the condition indicates general or local debility, the preparations of iron, as the subcarbonate or the citrate, or the sulphate of zinc, may be prescribed, with the Russian belt, and a diet easy of digestion. This course must be persevered in for weeks. Change of air should be recommended, and the bowels be kept open by enemata rather than by cathartics. Violent purgatives have always appeared to be positively injurious. Where narrowness of the canal exists, it must be treated as noticed under Constipation; and when attacks of enteralgia supervene, they must be met as inculcated elsewhere. (See Colic.)

In almost all cases of torpor of the colon, the writer has found decided advantage from a generous diet, restricted, however, in quantity, and from the use of a glass or two of dry wine, as sherry, at dinner. (Holland, *Medical Notes and Reflections*, Amer. edit. p. 108: Philad. 1839; and the writer's *Practice of Medicine*, 2d edit. i. 155: Philad. 1844.)

Robley Dunglison.]

COMA, (from κῶ, or κέω, to lie down,) a propensity to sleep; in pathology, a suppression, more or less complete, of the powers of sensation, thought, and voluntary motion. This may occur in various degrees, from a state of slight temporary drowsiness and torpor to one of profound and permanent stupor with general paralysis both of feeling and motion. The mental powers alone may be affected, whilst sensation and voluntary motion remain unimpaired. There may be suspension only of some of the intellectual faculties, as occurs in somnambulism and several forms of lethargy; or thought, sensation, and voluntary motion may be alike completely abolished, and life only sustained by a partial supply of nervous influence to the involuntary organs. These modifications of disease are easily accounted for by the natural divisions of the nervous system into parts having distinct functions.

Coma is a symptom not characteristic of any one condition of the brain, but may exist in connexion with morbid actions very different and even opposite in their nature. Nosologists have on this account been greatly embarrassed how to dispose of comatose affections in their classifications of disease, so as to bring them under one head. By attempting this they have introduced a degree of confusion calculated to lead to dangerous mistakes in practice; for comatose affections, decidedly connected with an inflammatory condition of the brain, have been erroneously ranged under the class *neuroses* or *adynamiæ*, to which classes some other of these affections, originating in debility, legitimately belong. Coma may either be a primary affection, or supervenes, in the course of other diseases, as a symptom. In Cullen's system, comatose affections constitute the first order of the class *neuroses*, under the title Comata, which order is divided into two genera, *apoplexy* and *paralysis*. Those affections which are more especially comatose, such as apoplexy, carus, cataphora, catalepsy, ecstacy, and all the varieties of lethargy, are included under the first genus. Dr. Mason Good, in his Nosology, classes all the affections characterized by torpor, either mental or corporeal, under the genus *carus*, having six species—asphyxia, ecstasis, catalepsia, lethargus, apoplexia, paralysis. The strong sympathy which the different parts of the brain and nervous system have with each other, establishes a close connexion between several of these forms of coma, and they not unfrequently pass into one another. In the present article we intend to confine ourselves to a brief description of the characteristic features of each of these affections; a more detailed history of some of them will be given under separate heads.

By *lethargy* is meant a torpor both mental and corporeal, with deep quiet sleep; it has a close affinity to natural sleep, differing chiefly in being more prolonged, and depending on a morbid condition of the brain. This is the slightest form of coma, and has been termed also, by some writers, *cataphora.*

Catalepsy, or trance, is a total suspension of sensibility and voluntary motion, mostly also of mental power: the pulse and breathing continue natural, the muscles are flexible, the body yielding to and retaining any given position. (See Catalepsy.)

Ecstacy is a total suspension of sensibility and voluntary motion, mostly also of mental power; the pulse and breathing remain natural, the muscles are rigid, the body erect and inflexible. It is persons of a nervous temperament and ardent imagination, much given to reverie and deep abstraction, who are most subject to this affection. The power of attention appears wholly concentrated on one train of thought engaging only a few of the intellectual faculties, whilst the others remain in a state of complete torpor. The patient seems to experience, for the time, a high degree of intellectual enjoyment. This is the description of ecstacy given by ancient writers, by some of whom it has also been termed catochus and catoche.

There is a complete abeyance of the mental faculties, of the external senses, of feeling, and voluntary motion, in the most perfect and aggravated forms of coma. The pulse is generally very slow, either full and soft, or small and hard; sometimes intermittent, at others, however, rapid, feeble, and irregular. The breathing is slow, laboured, and stertorous, the stertor arising from the relaxation and paralysis of the muscles of the internal fauces. There is sometimes dropping of the lower jaw and distension of the cheeks at each expiration, with difficulty of deglutition. The pupils are dilated and insensible to the strongest light: in some cases, however, they are either contracted or insensible, or one pupil is contracted and the other dilated. The surface of the body and the extremities are cold and clammy; the patient lies supine, and there are several other distressing symptoms indicating the rapid approach of death. This is the form of coma that generally attends diseases affecting the structure of the brain,—apoplexy, paralysis, meningitis, cerebritis, hydrocephalus, &c. It has been named by some nosologists *carus*. Others have described coma as a degree of torpor more profound than lethargy, but less than carus. Coma is sometimes attended with low muttering delirium, and has then been called *coma vigil;* and when resembling more a profound sleep, *coma somnolentum.*

The attack of coma is sometimes sudden, without any premonitory symptoms, and it may assume at once its most aggravated character, terminating speedily in dissolution. In other cases the loss of sense and motion is less complete, and consciousness returns in a few minutes or hours. There may be a recurrence of the attack in either regular or irregular paroxysms, as occurs in epilepsy. The invasion and progress of the complaint are, however, sometimes very slow. It commences by a tendency to drowsiness, which gradually increases until it reaches the state of complete coma. It frequently succeeds or alternates with convulsions and high delirium, and in such cases is to be considered a symptom of worse omen than delirium.

The most frequent and obvious cause of coma is pressure on the brain. A state of perfect coma can be produced artificially by applying pressure to the brain of an animal, and the coma is relieved the moment the pressure is taken off. The brain is exposed to pressure from a variety of causes. The principal of these are, congestion, inflammation, effusions of blood, pus, or serous fluid, organic tumours seated in the brain, in its membranes, or on the parietes of the skull, fractures of the skull, with depression, &c. Coma is perhaps too frequently attributed to serous effusion in the brain, which may exist in a considerable degree without any coma, more especially when it takes place very slowly. Sudden attacks of temporary coma sometimes occur in consequence of the distended state of the stomach and bowels, compressing the large vessels in the neighbourhood of the heart, and causing an accumulation of blood in the head.

Another very important and not uncommon cause of coma is a deficiency of nervous energy of the brain. There are various ways in which this may happen. It may take place suddenly, as the consequence of a violent shock or commotion given to the brain by a fall or a blow, causing some temporary derangement of the contents of the head, and suspending the operation of the nervous principle; this is termed concussion. The same effect may be produced without any physical cause, by violent impressions made on the nervous centres, and suddenly paralysing, as it were, the action of the nervous principle, as sometimes happens after strong mental emotions, or the intense pain of severe operations. In such cases the patient sinks into a state of profound coma, from which there are instances of his never recovering; nature appearing, as is remarked by some writers, suddenly to relinquish the struggle. Intense cold acts on the brain and nervous system by producing a state of numbness and torpor which speedily passes into coma, and terminates in death.

This loss of power in the functions of the brain, or in the nervous principle of the brain, may however have occurred very gradually; and the fact of this being a cause of coma is a highly important one, which, until lately, had been too much overlooked. The profession is much indebted to the late Dr. Good and to Dr. Marshall Hall for having directed their attention to this principle in pathology. After protracted attacks of inflammatory diseases, when the patient, although considerably weakened, is considered nearly convalescent, he sometimes falls into a state of coma, preceded occasionally by acute cerebral symptoms. Children are particularly subject to this variety of coma from exhaustion; they lie in a state of insensibility, the pupils dilated, the eyes open and insensible, the face pale, the skin cold, and the pulse feeble; they may continue for a day or two in this kind of stupor, and then recover. We apprehend, however, that these symptoms have often been mistaken for those of hydrocephalus, and that death has been hastened by the active treatment employed. There are in other cases symptoms of considerable nervous irritation, headach, delirium, great frequency and irregularity of pulse, general restlessness, which are sooner or later succeeded by fatal coma. This affection has been observed in persons who had long suffered from great mental distress. Dr. Kellie and Dr. Abercrombie have attempted to give an explanation of these phenomena, which appears not unreasonable; they suppose that when the general volume of the blood is much diminished, that balance of the circulation in the brain which seems necessary for the healthy condition of its functions is destroyed; that the arteries of the brain become contracted in their caliber, in consequence of receiving a less quantity of blood; but that, as the whole quantity of blood in the head must always continue nearly the same, a proportionate accumulation takes place in the veins and their sinuses, producing venous congestion. The considerable venous congestion observed in the heads of animals which have been bled to death, whilst the other parts of the body are blanched, and drained of their blood, favours this explanation. Some of the old writers mention a form of apoplexy analogous to this affection, to which they have given the name of *apoplexia ex inanitione.* A state of high mental excitement is in some cases followed by collapse and coma. This happens in individuals endowed with a highly sensitive and irritable nervous system, possessing more imagination than judgment, and subject to alternations of great exhilaration and a proportionate depression of spirits. It is persons of this temperament who are generally exposed to attacks of lethargy, catalepsy, somnambulism, &c. The coma of hysteria belongs to the same class of cases.

The use of certain medicinal and other substances may be followed by coma, in consequence of their specific action on the brain and nervous system. This is the case with narcotics and spirituous liquors. The effects of spirituous liquors and of some stimulating narcotics, may partly be accounted for by their causing an increased flow of blood to the head, and a temporary congestion; but, independent of this, they have a direct and specific action on the nervous energy, which they first highly stimulate and disturb, and next appear to prostrate and paralyse. This is what occurs in intoxication from alcoholic liquors and opium. There are other powerful narcotics, the effect of which seems to be that of at once paralysing and extinguishing the nervous energy without previous excitement, causing thus almost instantaneous death. This is the mode of operation of the upas, tobacco, belladonna, &c. Some narcotics stimulate in small doses, and cause direct stupor in large doses.

Amongst the causes of comatose affections are to be mentioned, retrocedent gout, the suppression of exanthems or old sores, of the hemorrhoidal and menstrual flux, &c. In cases of coma, strict inquiry into these points should never be omitted.

The great practical importance of being able to distinguish accurately between the different varieties of coma must appear obvious, when we consider how widely the causes which have just been enumerated differ from each other in their nature, and that the most opposite remedies will be required for their removal. The diagnosis, however, in these affections is sometimes involved in great obscurity; and when the attack of coma is sudden, as the physician is required to act immediately, he may find himself placed in a delicate and perplexing situation, for the life of the patient may depend on his selecting the right course of treatment.

The important question he will have to determine is, the exact condition of the brain to which the symptoms of coma owe their existence; whether they are to be ascribed to any of the causes of cerebral pressure, such as congestion, effusions of blood, pus, or serous fluid, fractures of the skull, with depression, &c.; whether simply to the weak and torpid state of the nervous energy of the brain, or whether finally to both these causes, and in what degree they are combined. Much correct information respecting these points, and the degree of danger with which the case is attended, will be obtained by inquiring carefully into the state of the circulation and respiration, and into that likewise of the temperature and sensibility of the surface of the body and of the extremities: an accurate account of the patient's state of health previous to the attack will sometimes throw considerable light on its nature.

In the milder forms of coma, the structure of the brain is not affected; there is only a slight degree either of vascular congestion or of nervous torpor, or else a combination of both these conditions. The patient lies in a quiet sleep, out of which he can sometimes be momentarily roused by calling aloud or shaking him. The breathing is tranquil and free; the pulse soft and regular; the temperature of the body natural, and the feeling but little impaired; the pupils may be a little dilated, but retain some degree of motion. This is the usual condition of the patient in attacks of lethargy, catalepsy, ecstacy, and in the coma which follows moral emotions. When coma supervenes on gradual exhaustion, the antecedent circumstances of the case, the pallidness of the countenance, feebleness of the pulse, and coldness of the surface, will sufficiently point out its true nature.

The characteristic features of the most aggravated form of coma have already been described; they are generally to be ascribed to some disease seriously affecting the structure of the brain, or else to a formidable prostration of its nervous power. Stertorous breathing has been insisted on as a sure sign of danger; its absence is not, however, to be taken as a proof of the reverse. But we may lay down as a general rule, that the danger is always in proportion to the degree in which the respiration, the circulation, and the temperature of the body are affected.

The distinction between the coma which follows simple concussion of the brain, and that arising from compression in consequence of fracture and depression of the cranium, or else effusion of blood on its inner surface without fracture, has been a point of interesting inquiry with surgical writers; having principally for its object to determine under what circumstances operations are to be performed in injuries of the head. A great deal of valuable information on this subject is to be collected from the works of Pott, Abernethy, and Dessault. Cases of slight concussion are easily distinguished from compression, the patient still retaining some degree of consciousness and feeling, and the stupor being soon relieved. But in cases of very violent concussion, where the prostration of the sensorial power is extreme, the coma is so complete, and the symptoms so closely resemble those of compression, that the most experienced observers acknowledge the difficulty of drawing any exact line of distinction between them. The chief source of apprehension in simple concussion is the period of stupor being followed by one of inflammatory reaction.

Abernethy gives the following very graphic account of concussion, which he thinks may be divided into three stages. The first stage is that of insensibility and derangement of the bodily powers, which immediately succeeds the accident. Whilst it lasts, the patient scarcely feels any injury that may be inflicted on him. His breathing is difficult, but in general without stertor; his pulse intermitting, and his extremities are cold. But such a state cannot last long; it goes off gradually, and is succeeded by another, which he considers the *second* stage of concussion. In this, the pulse and respiration become better, and though not regularly performed, are sufficient to maintain life and to diffuse warmth over the extreme parts of the body; the feeling of the patient is now so far restored that he is sensible if his skin be pinched; but he is stupid and inattentive to slight external impressions. As the effects of concussion diminish, he becomes capable of replying to questions put to him in a loud tone of voice, especially when they refer to his chief suffering at the time, as pain in the head, &c.; otherwise he answers incoherently, and as if his attention was occupied by something else. As long as the stupor remains, the inflammation of the brain seems to be moderate; but as the former abates, the latter seldom fails to increase, and this constitutes the *third* stage, which is the most important of the series of effects proceeding from concussion. These several stages vary considerably in degree and duration. Mr. Abernethy proceeds to observe that the treatment must be different in each of them, and to caution against the very free use of stimulants in the first stage, which is too often prescribed, and particularly against their continued exhibition in the third stage, when a plan of treatment directly the reverse is required.

The coma produced by excessive intoxication has some similarity to that of apoplexy, and we have known this lead to ludicrous mistakes, not very creditable to the practitioners' discernment. The smell of the breath will in most cases supply a sure means of avoiding such errors; in some extreme, though rare instances, actual coma has, however, supervened. It is deserving of notice that impostors, who feign epilepsy, with a view to extort charity, can always be detected by examining their eyes, when the pupils will be found in their natural state as to size and sensibility. In epilepsy they are almost always contracted and insensible. In coma they are generally, though not always, dilated, and their sensibility is more or less diminished.

Syncope and asphyxia bear a close resemblance to coma in many of their symptoms; they are characterized in common with coma, by the absence of sensation and motion, by dilatation and insensibility of the pupils, &c. They differ chiefly, however, in the state of the respiration and general circulation. The *primary* cause of syncope is a diminution or temporary cessation of the action of the heart; the brain being thus deprived of the usual supply of its natural stimulus, the flow of nervous influence from the sensorium, which is indispensable for the maintenance of all the actions of life, is suspended, and a general torpor with other symptoms of apparent death is the necessary consequence. In asphyxia the circulation is also stopped, through the interruption of the functions of the lungs. The primary symptoms therefore in both these diseases are a great feebleness or complete suspension of the action of the heart and lungs, and the occurrence of coma is but secondary; while, when the same symptoms occur in coma, it is only secondarily and in its advanced stages. It is not unimportant to attend to these distinctions, for we have seen a protracted fit of syncope in a fat corpulent person mistaken for apoplectic coma, and the adoption of active remedies nearly followed by fatal consequences.

As the treatment of the various kinds of comatose affections will be described under their respective heads, we intend in the present article to confine ourselves to some general observations on bloodletting in this class of diseases. When a person is suddenly deprived of sense and motion, the practitioner sent for is expected by the alarmed friends to employ instantly some active and efficient means of relief, and it is a very general rule with the profession to have recourse at once to the lancet. Should there even be any doubt in the mind of the practitioner respecting the propriety of such a course, he may still be driven to adopt it, in deference to the opinions of the public, who ignorantly conclude that, because bloodletting affords relief in some sudden fits, it is equally essential in all. If the patient recovers, the cure is attributed to the venesection; and if he dies, it is hastily inferred that nothing would have saved him. If we turn, however, to a calm consideration of the various and very opposite causes of comatose affections, it will appear a most obvious truth that nothing can be more contrary to the legitimate deductions of science, and more dangerous in practice, than this indiscriminate and empirical use of the lancet. It has been seen that among the causes of coma, some are connected with morbid conditions of the substance of the brain, for the removal of which bloodletting is the only, if not a sovereign, remedy; but that on the other hand coma is frequently to be ascribed to a deficiency or prostration of the nervous energy of the brain, in which case it is evident that the subtraction of any large quantity of the vital fluid can only have the effect of preventing the powers of the constitution from rallying, and of thus turning the scale against the patient's recovery. We have little doubt that some of the recoveries from coma after bloodletting ought to be considered as lucky escapes from death, rather than cures.

There are, as just stated, well-marked cases in which there cannot be a shadow of doubt as to the propriety of venesection; as, for instance, when the coma is very profound, with a flushed face, hot skin, full and strong pulse, stertorous breathing, &c. But when in the young, the aged, or the infirm, there are evident symptoms of great debility; when the face is pale, the skin and extremities cold, the pulse feeble, the breathing not much embarrassed, &c., the propriety of general depletion to remove symptoms of coma is more than questionable; all the relief that bloodletting is capable of affording can be obtained from cupping or leeches, should even local depletion be thought necessary; and we have seen coma depending on cerebral pressure very quickly relieved by the abstraction of only three or four ounces of blood from the head; an apparently trifling cause being sometimes sufficient to destroy the balance of the circulation in the brain.

We are aware that there may be cases in which the indications both for and against general bloodletting are so nicely balanced, that it is difficult to determine which course to pursue. Under such circumstances we must proceed with great caution,—and a small bleeding may be tried for the purpose of exploring the nature of the case; we should watch the effects produced, as the blood flows; and in all doubtful cases it is preferable to take a small quantity only at first, as the operation can easily be repeated if judged advisable. In coma as well as in asphyxia, when the powers of life are sunk very low and appear to be fast ebbing, a favourable re-action is sometimes prevented from taking place by the circumstance of either the brain or the heart being completely overpowered by an excessive accumulation of blood. The timely abstraction of a very few ounces of blood has sometimes appeared to be of essential service in such cases, by relieving the mechanical oppression of the organ, and enabling it to recover a slight degree of action, sufficient perhaps to lead gradually to a favourable re-action in the other vital functions; whilst copious bleeding under similar circumstances would most probably have completely extinguished the remaining sparks of life.

The temperature of the surface of the body may be considered one of the safest guides with respect to the propriety of bloodletting, together with the state of the pulse and the action of the heart. We have never, indeed, seen beneficial effects follow venesection, when the animal heat has been very low, even although the strength of the pulse might appear to justify its being prescribed. The temperature of the body is, perhaps, a safer general criterion of the exact condition of the powers of life than even the pulse; for do we not see the arteries pulsating and throbbing with great force and frequency in cases where there is an undoubted tendency to debility and sinking? Whilst, however, a low state of the animal temperature is sufficient of itself to counter-indicate copious depletion, the opposite condition must not always be conceived to justify the use of the lancet; for a morbid pungent heat is a frequent attendant on a state of great irritability of the nervous system, characterized also by a quick throbbing irregular pulse, but indicative of a general and dangerous deficiency of the powers of life. This important point of pathology will be more fully examined in the article INFLAMMATION. We shall conclude therefore by repeating, that the practice of bleeding rashly and indiscriminately to a large amount in all cases of sudden loss of sense and motion, cannot be too strongly deprecated. A good paper on this interesting subject, by Dr. Latham, will be found in the 6th volume of the Transactions of the London College of Physicians.

ADAIR CRAWFORD.

[**COMBUSTIBILITY, PRETERNATURAL.** (See COMBUSTION, SPONTANEOUS.)]

COMBUSTION, SPONTANEOUS HUMAN. When we reflect upon the difficulty with which the proximate principles of the animal kingdom are made to undergo combustion, even when exposed under the most favourable circumstances to an elevated heat, it is not to be wondered at that relations of this process having spontaneously occurred should have been received with suspicion and ascribed for a length of time to credulity or imposture. That cases, however, of this kind have really taken place seems now established by indisputable evidence; but while the fact is very generally admitted, we are still, as in the instance of meteoric stones, at a loss for an adequate explanation of it. Before entering upon an analysis of the different conjectures which have been hazarded upon so obscure a subject, we shall first quote, for the purpose of illustration, a few well-authenticated instances of individuals who have fallen victims to this most mysterious of all human affections.

Cornelia Bandi, Countess of Cesina, an Italian lady, sixty-two years of age, having felt drowsy one evening, retired earlier than usual to bed, and was attended by her maid until she fell asleep. When the girl on the following morning entered her mistress's apartment for the purpose of awakening her, a dreadful spectacle presented itself. At the distance of four feet from the bed there was a heap of ashes, in which the head, legs, and arms of the countess alone could be traced. The head lay between the legs, but the half of its posterior part, together with the brain and chin, were entirely consumed. The legs and arms were uninjured. The ashes, which alone remained of the rest of the body, when touched, left upon the fingers a greasy fetid moisture; and a sooty matter was deposited upon the furniture and tapestry, and had even penetrated into some drawers and soiled the linen which they contained. There was no unusual derangement of the bed, the bedclothes being merely thrown aside, as is the case when a person gets up. The wax of two candles placed upon a table near the bed was melted, but the wicks remained unconsumed. It is deserving of remark that it was a constant practice of this lady to bathe her body with camphorated spirit of wine. This case was first published by Bianchini, but is chiefly known to the British public in a paper communicated to the Royal Society by Dr. Cromwell Mortimer, and which may be found in the Philosophical Transactions for the year 1745.

Don G. Maria Bertholi, a friar, who lived in Mount Volere, went to the fair of Filetto, and having walked about all day, retired in the evening to the house of a relation at Fenile, to spend the night. Upon his arrival, he went direct to his bed-room, and had a handkerchief placed between his shoulders beneath his shirt. In a few minutes after, having been left alone, a singular noise, mingled with cries, was heard from his room; and when the people of the house rushed in, they found him on the floor, surrounded by a lambent flame, which retired as they approached. When visited next morning by Joseph Battaglia, a surgeon of Ponte Basio, the integuments of the right arm were found loosened from the muscles, and hanging down, and those of the back, between the shoulders and the thighs, were in the same state. The part of the right arm which had sustained most injury appeared in a state of incipient putrefaction, and next day was quite gangrenous. On the third day there were thirst, fever, violent convulsions, fetid stools, vomiting, and delirium; and the gangrene had extended to all the injured parts. On the fourth day he fell into a comatose state, which lasted two hours, and then died. Battaglia observed, during his last visit, that putrefaction had commenced, and indeed had already made considerable progress. The nails had loosened and were ready to fall off. The stench was insupportable, and maggots crawled from the body at every point. The account which the patient gave of his singular attack was, that he felt a blow upon the right arm as if inflicted by a club, and then saw a spark hanging to his shirt-sleeve, which immediately reduced it to ashes. The handkerchief already spoken of, as also his drawers, were uninjured; but his nightcap was consumed, although his hair was not touched. There was no empyreumatic smell, and not a trace of fire or smoke in the room. It should also be observed that the night was calm, cool, and clear.

A detailed account of this case appeared in the Allgemeine Literatur Zeitung, for 1786. It has been transcribed by most writers on juridical medicine, partly in consequence of its singularity, but chiefly because it is conceived to illustrate and support the electrical theory of the origin of what is denominated spontaneous combustion. It is also remarkable as being the only well-established instance of an individual who suffered from such a calamity having lived sufficiently long to give an account of the manner in which he was attacked.

Anne Nelis, wife to a wine and porter merchant, living in South Frederick street, Dublin, let in her husband, who had been out at a party, between twelve and one o'clock on a Saturday night. After some altercation had taken place between them, both being in a state of intoxication, Mr. Nelis went up stairs to bed, but in a few minutes came down to request his wife to accompany him, an invitation which she positively declined; upon which he took with him her candle, observing that if she was determined to sit up, she should do so in the dark. Next morning the maid-servant having opened the windows of the back parlour, observed something in the arm-chair in which Mrs. Nelis usually sat, which she at first sight imagined to have been put there by young Nelis, who at the instant entered the room, for the purpose of frightening her. Upon examination, however, it turned out to be the remains of her mistress, who was found in the following state. She was seated in the chair, at a distance from the fire, which appeared to have burned out, with her head leaning upon her right hand, and bearing behind against the wall. The trunk of the body was burned to a cinder, as also the clothes which invested it; but the pelvic region, the lower and upper extremities, and such portions of her dress as covered these parts, sustained no injury. Her face had a scorched appearance; but her hair, and the papers she had put in it, had entirely escaped. The back and seat of the chair had not suffered, but its arms were charred on the inner side where in contact with the body. With the exception of the arms of the chair, the combustion had not extended to surrounding bodies. The room was filled with a penetrating and offensive odour, which was still perceptible after the lapse of several days. This woman was about forty-five years of age, of low stature, had rather a tendency to corpulence, and was a confirmed drunkard. The preceding facts may, we believe, be depended on, though we have experienced very considerable difficulty in collecting them. Strange to say, there was no inquest; and such was the anxiety of the family to hush up every thing connected with the occurrence, that a request made by Dr. Tuomy, late Professor of Physic in the School of Medicine, to be permitted to examine the body, was refused.

The following case is extracted from the Methodist Magazine for 1809, as related by a Mr. Wood, a Wesleyan minister, then residing in Limerick. "Mr. O'Neil, keeper of the Five Pounds Alms-House in the city of Limerick, was awakened about two o'clock at night by a person knocking at his room door, upon which he arose, and having inquired who knocked, he opened the door, and going with the person who had called him into his apartment, which lay under Mrs. Peacocke's room, he found a dead body lying on the ground burning with fire, and red as copper, having dropt down from the loft, which was on fire. Examining the loft, he saw a large hole, the size of the dead body, burned through the boards and ceiling. He instantly ran up stairs, and having burst open Mrs. Peacocke's room-door, saw in the middle of the room the burnt hole through which the body had fallen. Having with assistance quenched the fire about the hole, he examined by what means the body had taken fire, and could find no cause. There was no candle or candlestick near the place, no fire in the grate but what was raked in the ashes, as is the manner of preserving fire by night; the room was examined, and nothing had taken fire but that part of the floor through which she had fallen. Even a small basket made of twigs, and a small trunk of dry wood which lay near the hole, escaped, and were not so much as touched by the fire.

"This phenomenon was the next day examined by the mayor, clergymen, and several gentlemen of the city. The impossibility of ascertaining the cause of the fire, the extraordinary circumstance of no part of the room being burnt but the centre of it, through which she had fallen, added to the well-authenticated circumstance of her recent diabolical imprecations and lies, obliged every observer to resolve so awful an event into 'the visitation of God's judgment in the punishment of a daring and persevering sinner.' " —It is proper to add here, that for the leading facts of this case we do not rely solely upon the Methodist Magazine. They have been detailed to us in a letter received from Mr. Wood himself, and confirmed by an intelligent lady residing in Limerick, who personally inspected the floor through which the hole was burned; the repairs undergone by which still point out the spot at which the perforation took place. We should not omit to mention that Mrs. Peacocke was about sixty years of age, and that she indulged immoderately in intoxicating liquors.

Mrs. Stout, widow of a watchmaker, and married a second time to a man of the name of Hanna, went to bed one evening in apparent health, and was found next morning burnt to a cinder on the floor of her bed-room. When discovered, a vapour was still issuing from her mouth and nostrils, and those parts of the body the form of which had not been altered, immediately crumbled down upon being handled. Her chemise and nightcap escaped uninjured. This case occurred in 1808, at a place called Coote Hill, in the county of Cavan. The subject of it was about sixty years of age, and an inveterate dram-drinker. An inquest was held, and from the impossibility of accounting for the occurrence upon any known principle, the verdict was—"death by the visitation of God."

A. B., a woman of about sixty years of age, who lived with her brother, in the county of Down, retired one evening to bed with her daughter, both being, as was their constant habit, in a state of intoxication. A little before day some members of the family were awakened by an extremely offensive smoke which pervaded their apartment, and on going into the chamber where the old woman and her daughter slept, they found the smoke to proceed from the body of the former, which appeared to be burning with an internal fire. It was as black as a coal, and the smoke issued from every part of it. The combustion having been arrested, which was effected with difficulty, although there was no flame, life was found completely extinct. While the body was being removed into the coffin, which was done as soon as possible, it was dropping in pieces. Her daughter, who slept in the same bed, sustained no injury; nor did the combustion extend to the bed or bed-clothes, which exhibited no other traces of fire than the stains produced by the smoke. According to the testimony of one of the relations, who is represented as a woman of the strictest veracity, there was no fire whatever in the room. The subject of this case had been grossly intemperate for several days before her decease, having drunk at this period much more ardent spirit than usual.

For the preceding facts we are indebted to the Rev. Mr. Ferguson, of Camden-street, Dublin. They are given almost exactly in his own words. He had professional opportunities of acquaintance with the family, and he states that shortly after the occurrence, he examined the room in which the old woman had been burned, and satisfied himself that the fire had not extended to the bed, bed-clothes, or furniture.

From the cases just related, and several others which might be quoted from the writings of Vic D'Azyr, Lecat, Lair, Kopp, Dupuytren, and Marc, it would appear fully proved that the human body is capable of being reduced to such a state as to undergo spontaneously, [?] or upon the contact of flame, rapid changes analogous to those which may be effected by the agency of fire. A careful examination, also, of the histories of the several instances upon record, has enabled us to collect, at least with some probability, the circumstances which precede, accompany, and characterize this malady; for such it obviously must be considered. These we shall now enumerate, as they will serve as a guide to our inquiries respecting the immediate or proximate cause of the phenomenon.

1. Spontaneous combustion would appear to be a calamity almost peculiar to the old and feeble; for it has seldom occurred to persons of a robust constitution, or under sixty years of age.

2. Women seem particularly prone to it. Thus, of the seventeen cases collected by Kopp, sixteen occurred to females, while the subjects of the eight cases mentioned by Lair are all of the same sex.

3. Individuals who have thus suffered have, generally speaking, been remarkable for the inactivity of their habits, for corpulency, or the opposite state, great emaciation, and for their inordinate use of spirituous liquors.

Of the circumstances which distinguish spontaneous from ordinary combustion, the following seem most deserving of notice:—

1. The combustion spreads with extraordinary rapidity; the decomposition of the entire body being usually effected in an extremely short period of time.

2. The flame is of a lambent and flickering nature, of a blue colour, very difficult to extinguish by water, and not readily communicable to inflammable bodies placed in its vicinity.

3. A strong empyreumatic odour is usually exhaled, and there is found upon adjacent objects a fetid and moist fuliginous deposit, of a greasy nature.

4. The trunk is generally entirely consumed, but portions of the head and extremities are occasionally left uninjured.

Before examining the theories which have been advanced in explanation of spontaneous human combustion, it will be convenient to define in what *ordinary* combustion consists, and the conditions indispensable to its production. We shall thus be the better prepared to pronounce upon received hypotheses a correct and impartial judgment.

When any two forms of matter, whether they be simple or compound, combine chemically with the evolution of heat and light, combustion is said to have taken place. In order, therefore, to the production of these phenomena, the contact of at least two dissimilar principles, having for each other a strong affinity, is essential. Combustion may thus obviously result from the chemical action of a variety of principles; but, in all ordinary cases, one of the substances concerned is oxygen, and the other carbon, or hydrogen, or some compound of both these elements. If to these we add sulphur and phosphorus, which are associated with the preceding as component parts of animal bodies, we shall have enumerated all the elements with which we can have any thing to do in our present discussion.

But the mere contact of oxygen with a combustible is seldom, of itself, sufficient to determine union, much less union with the development of heat and light. Carbon and sulphur may be encompassed by oxygen, and hydrogen mixed with it, without the occurrence of any chemical action; and though this is not true of phosphorus, the union of which with oxygen takes place at the usual temperature of the atmosphere, yet the process is slow, and visible flame is altogether wanting. These observations are equally applicable to the compounds which the combustibles form with each other, with a single exception. All of these but phosphuretted hydrogen, which inflames upon mere contact with oxygen gas, require, in order to accension, the application of a somewhat elevated heat. Neglecting, therefore, for a moment, this particular compound, it may be laid down that the conditions of ordinary combustion are two-fold:

1. That the combustible be in contact with oxygen.
2. That its temperature be considerably raised.

Now the human body is a combustible compound, and is constantly surrounded by an elastic medium, one-fifth of whose volume is pure oxygen gas. One of the conditions, therefore, necessary to combustion, is here fulfilled; and experience tells us that the co-existence of the other, that is, of a sufficient heat, will actually determine accension. But the human body, at least in a state of health, does not spontaneously take fire; and we also know that when heat is applied to any particular part of it, the mischief done is local, and does not extend to remote organs. In reference, therefore, to the subject of this article, two questions present themselves for solution.

First, whence arises that extreme degree of inflammability of the human body, in virtue of which its combustion is so readily produced, and occurring at any one point, is propagated with rapidity to distant parts? And, secondly, how does the combustion commence — what is the origin of the first spark?

As to the cause of the preternatural combustibility of the human body, the opinion generally entertained is, that it is to be found in the alcoholic impregnation, which, as is alleged, invariably accompanies such a state. In support of this doctrine, it is affirmed that individuals who die of intoxication emit at every point a strong smell of spirits; that the colour of the flame afforded by the latter is precisely the same as that which has been observed in cases of spontaneous combustion; and, lastly, that all who have fallen victims to this calamity have been remarkable for the immoderate use of intoxicating liquors.

That the bodies of drunkards may become, as it were, soaked with alcohol, seems fully established by observation. Thus, Breschet found the different tissues of the bodies of criminals, opened shortly after their execution, to evolve a strong smell of eau-de-vie; and a similar observation has been made by Dumeril and Cuvier upon the body of a labourer, at the Garden of Plants, who had died from the effects of a large quantity of wine, which he had drunk for a wager. Dr. Marc also mentions the case of a shepherd of Laliowitz, addicted to excessive drinking, who during his last illness was constantly affected with eructations of an inflammable nature, and which emitted a strong alcoholic odour. Some, indeed, adopting an ancient physiological dogma, that, however the ingesta may vary, the chyle is always the same, deny the possibility of alcohol entering the circulation unaltered. It should, however, be recollected that many substances, such as the colouring matters of madder and rhubarb, and the odoriferous parts of musk, camphor, and garlic, do certainly resist the assimilating powers of the digestive apparatus, and re-appear unchanged in the secretions. Nor are such facts even opposed to the opinion to which allusion has just been made. These substances may enter the blood directly by the veins, which are now known to exercise the function of absorption, instead of reaching it through the circuitous route of the lacteals and thoracic duct.

But the theory of alcoholic impregnation is, *per se*, quite insufficient. When a healthy individual dies of intoxication, his body is found but little, if at all, more inflammable than if he had perished from any other cause; and if the flame of a candle be applied to an anatomical preparation just removed from the spirits in which it has been preserved, after the combustion of the alcohol has ceased, the surface of the preparation alone will be found burned.

From these considerations it appears pretty certain, that though the human body may to a certain extent become impregnated with alcoholic vapours, its combustibility will not, by this alone, be materially augmented; and that, therefore, when a great tendency to combustion exists, it must be the result of some peculiar pathological state. In what this state consists, it is probably impossible, with any accuracy, to assert in the present state of our knowledge; but every thing which we know upon the subject justifies us in inferring that the causes which produce it are such as have most influence in reducing the powers of life and enervating the system. Thus it occurs, as we have seen, almost exclusively to people advanced in years, and of constitutions broken down or enfeebled by intemperate habits.

A theory of preternatural human combustibility has been more recently advanced by Dr. Marc, which appears better sustained by facts than that of alcoholic impregnation. This learned physician, who has apparently studied his subject with great attention, contends that the combustion is owing to inflammable gases which are, in such cases, developed throughout the system.

That inflammable gaseous products are usually present in the stomach and intestines, in health as well as in disease, is a fact well known to the physiologist; but it seems difficult to admit that these can be evolved in the different tissues during life; for such an opinion would appear to involve the possibility of the occurrence of some degree of spontaneous decomposition antecedent to death. There is, however, sufficient evidence that this has occasionally occurred. Besides the case of Father Bertholi already detailed, several others to this effect might be quoted. We shall, however, confine ourselves to the following, which is of recent date, and quite to the purpose.

A man ill for fourteen days with headach and colic pains, followed by an attack of diarrhœa, which lasted three days, was taken by M. Bally into the Hôtel-Dieu. Upon entering the hospital, his left thigh and scrotum were swollen, and his respiration was short and impeded; but he complained of nothing but weakness of the lower limbs. During a fit of delirium, which lasted a few minutes, he spoke of having been bitten by a dog in the leg; but upon examination no mark of any such injury could be found. He died on the night of the day on which he had been admitted into the hospital, and on examination eight hours after, exhibited the following appearances:—Blood had transuded from the thighs and trunk, and was also found, in a gelatinous state, in the nasal cavities. The whole of the surface of the body was emphysematous, of a violet colour, and studded with a vesicular eruption in detached spots, the vesicles being filled, some with a reddish serum and gas, others with gas alone, the latter being of a white colour. The left leg and thigh were most swollen and puffy, and evidently contained fluid. The abdomen and scrotum were also much distended, the gas in the former occuring not within the intestines, but in the cavity of the peritoneum. The brain and spinal marrow were healthy, but the vessels of the pia mater contained air. Upon cutting into any emphysematous part, a gas escaped, which was set on fire by the flame of a candle; and from a perforation made in the abdomen a gas issued, which was ignited in a similar manner, and burned with a bluish flame.

This case, which was communicated to the Académie Nationale de Médecine, excited a good deal of discussion. M. Bally considered it as illustrating Dr. Marc's theory of spontaneous combustion, while others looked upon it as proving that the putrefactive process, from which alone they conceived the gases could be derived, may set in before death. This latter opinion may appear paradoxical, but it does not seem at all improbable, much less impossible, that a spontaneous though limited decomposition may in certain states of the system take place in the living body. The elements of organized matter are, we know, combined, under the influence of vitality, into compounds very different from those which they would form if submitted to the sole agency of their mutual affinities. When released from the controlling influence of the vital powers, they enter into new arrangements; and it is but reasonable to expect that effects similar, at least in kind, may attend the diminution of those powers which is the consequence of disease, to those which are known to follow upon their extinction by death.

It is not, however, necessary, in order to account for the development of the gases, to resort to the hypothesis of putrefaction. They may be the products of depraved secretion; and this opinion seems even established by the many cases upon record of the cellular substance having become emphysematous without the occurrence of any external injury. In fact, spontaneous emphysema is at present recognized by all nosologists. (See the article EMPHYSEMA; also *Frank de Retentionibus*, and the articles *Emphysème* and *Pneumatose*, in the Dictionnaire des Sciences Médicales.)

But though we admit with Marc, that inflammable gases may be developed during life throughout the different textures, yet this will not explain the completeness of the incineration which has been observed to occur, nor the rapidity with which the combustion spreads over the whole body. If a taper be applied to carburetted hydrogen, it will burn merely at its point of contact with the oxygen of the atmosphere; and to determine the instantaneous inflammation of a given volume of such gas, it must, previously to the application of the taper, be mixed with a certain quantity of oxygen. These facts, so familiar to the chemist, suggest a necessary modification of the hypothesis of Marc. The gases evolved cannot be all of an inflammable nature, but must include a proportion of oxygen, to act the part of a supporter. On this supposition they will constitute a species of explosive mixture, and we shall be enabled perfectly to comprehend the rapidity and the extent of the destruction which must ensue from their accension.

It must, however, be admitted that, though oxygen may proceed from secretion, it is a gas not likely to be liberated by any process of spontaneous change, for it does not occur amongst the products of putrefaction. The views, therefore, which have been here advanced must, until confirmed or refuted by chemical analysis, be considered as chiefly recommended by their adequacy to explain phenomena.

Having attempted to account for the preternatural inflammability of the human body, we shall now direct our attention to the manner in which the combustion commences. In most of the recorded cases some ignited body, as a candle, fire, or lighted pipe, has been found in the immediate vicinity of those who have suffered. The consequence of this has been that some have attributed the origin of the combustion in every instance to an external cause. Such was the doctrine first taught by Vic D'Azyr, and since sanctioned by Lair, Breschet, Dupuytren, and others. Should it prove well founded, the epithet *spontaneous* will obviously cease to be applicable to human combustion.

Others, however, amongst whom may be mentioned Maffei, Lecat, Kopp, and Marc, conceived this theory inadequate to the explanation of all the cases with which they were acquainted, and to supply its deficiency, called in the calorific powers of the electric fluid.

That electricity, in the form of a spark, is attended with the disengagement of heat, and is capable of setting inflammable substances on fire, are facts which cannot be contested. But the source of the electric accumulation, in the cases under consideration, remains to be satisfactorily pointed out. And, indeed, it may be added, that the statements that have hitherto been made upon the subject rest upon mere conjecture. Some conceive that certain persons possess the power of generating within themselves a state of electric tension, and quote relations of individuals who emitted sparks at the suggestion of the will. Dr. Marc has adopted this improbable hypothesis, and coupled with it one of his own, which appears equally destitute of foundation. The gases with which the body abounds in its combustible state sometimes become, according to him, ideo-electric, from an elevation of their temperature, whether produced by exercise, exposure to a fire, or any other cause; and hence proceeds the spark which determines the accension. Lastly, others conceive the spark when it occurs to be purely accidental, and to result from the electric fluid selecting the human body as a conductor in its passage to or from the earth. This latter supposition being the only one which in modern science is admissible, we arrive at the conclusion that electricity can scarcely ever have any thing to do in producing human combustion.

It is believed by some that cases of genuine spontaneous combustion have taken place, or that the human body has sometimes taken fire, as it were, of its own accord, without the application of external heat, or the agency of electricity. Assuming such to be the fact, can any rational explanation of it be assigned? This is almost the only question of a theoretical nature connected with the subject of this article which remains to be discussed.

Of the elementary principles which enter into the composition of the human body, phosphorus must be reckoned as one of the most abundant. It exists, in very considerable quantity, as a constituent of bones, and, in many of the secretions, in the form of phosphoric acid, united to some base; and is also to be found, in a peculiar state of combination, in the cerebral mass, and in the fat which is deposited throughout the cellular tissue. When putrefaction occurs in the dead body, experience proves that phosphorus is evolved amongst the gaseous products in union with hydrogen; and there seems little reason to doubt that this is one of the gases which are occasionally generated throughout the different textures of the living system. Now, if this be admitted, as phosphuretted hydrogen inflames upon contact with the atmosphere, we shall have a perfect and simple solution of the difficulty of *spontaneous* combustion. This theory was very early advanced, and has been particularly insisted upon by Morelli and Fanzago, and more recently by Grabner Maraschin: (*Journal Complémentaire de Dictionnaire de Médecine.*) It is, however, passed over in silence by the majority of writers.

There is another mode of accounting for the spontaneous combustion of the human body, which is entitled to a brief notice here. The chemical actions which give rise to the inflammable gases of which we have so often spoken, are attended by the development of heat; and when this rises beyond a certain point, combustion, it is alleged, must ensue.

In support of these views, the spontaneous firing of pyritic coal, heaps of charcoal, oat-meal, cotton, and black wad soaked with oil, are appealed to. Whatever may be thought of this hypothesis, the records of medicine prove that the production of inordinate heat may be classed amongst the well-established consequences of disease. In the Essay of Maraschin already quoted, three cases are detailed which will illustrate this position. We shall merely mention one which occurred, in 1822, to Balbiani, an Italian physician, and which was communicated by him to Morelli, Chemical Professor at Pisa.

A farmer, twenty-six years of age, was seized, in the beginning of January, with an intermittent fever connected with gastric irritation. On the seventh day he felt in the throat a burning heat, ascending from the region of the stomach, so intense as to resemble the effects of the application to the body of red-hot coals. His breath, which smoked, could not be borne by the hand at the distance of two feet. He incessantly drank cold water, but with only temporary relief. The thirst was succeded by a most voracious and insatiable appetite, the internal heat continuing unabated. He was treated by repeated immersion in the cold bath, conjoined with the exhibition of draughts of iced water; and was finally cured perfectly.

From the preceding facts and arguments the following conclusions may be deduced:—1. The human body admits of being reduced to a highly inflammable state. 2. This condition is chiefly owing to the development, by perverted secretion or incipient putrefaction, of gases constituting a more or less explosive mixture, but is probably often promoted by the dispersion throughout the system of alcoholic vapours. 3. In most instances of human combustion the process has commenced in consequence of the contact with the body of external fire, or of an electric spark. 4. Cases truly spontaneous, if any such have occurred, must be referred to the disengagement of phosphuretted hydrogen, or to the caloric developed by those internal actions which determine a highly combustible state of the body.

Before concluding this article, it will be proper briefly to advert to its medico-legal bearings. The human body, in a state of perfect health, may be consumed by accident or design, and it is obviously a matter of the first moment, with a view to the protection of innocence and the punishment of guilt, that we should be enabled to distinguish such cases from those in the consideration of which we have now been engaged. The importance of the study of spontaneous combustion under this point of view is usually illustrated, in works upon medical jurisprudence, by the celebrated case which occurred at Rheims in 1725. The wife of a man of the name of Millet, who was much addicted to the use of spirituous drinks, left her husband's bed one night, and was found next morning, at a short distance from the kitchen fire, reduced to a heap of cinders. Millet, who was suspected of intriguing with a handsome servant-girl in the house, was accused of the murder of his wife, and being sentenced to death, was saved from execution by the report of a commission of medical men, who, after having investigated all the facts, declared it to be a case of spontaneous combustion.

By attending to the circumstances already enumerated as characterizing spontaneous combustion, we shall be in no danger of confounding it with that which may be produced by the ordinary artificial means. Thus, when the subject of the calamity is a female, advanced in years, and of intemperate habits; when the destruction has been very rapidly effected, and nothing remains unconsumed but portions of the head and extremities; when the room is filled with an offensive empyreumatic odour, and a moist and fetid sooty matter is deposited upon the ashes which remain and upon the walls and furniture;—these circumstances, or the greater number of them concurring, remove all doubt respecting the spontaneous origin of the fire. On the other hand, when the combustion is of the ordinary kind, and has been the result of accident, it will generally be but partial, and not directed in preference to any particular part of the body. In such cases, also, it will almost invariably be found to have extended to adjacent combustible substances. Lastly, when designedly produced, there will be evidence of the consumption of a large quantity of fuel.

As to the appropriate treatment of individuals who manifest a tendency to spontaneous combustion, nothing certain can be laid down: nor is our ignorance on this head much to be lamented, at least in a practical point of view; for such an affection is seldom announced by any precursory symptoms. Should, however, such a case as that which occurred to Balbiani be encountered, nothing appears more judicious than the treatment to which he resorted, namely, immersions in the cold bath, and copious draughts of cold water. Dr. Swediaur, indeed, states that spontaneous combustion is very prevalent in the north of Europe, from the excessive use of eau-de-vie, and that the tendency to it, when detected, is with certainty removed by the administration of recently voided human urine. Upon this statement Fodéré observes, "*credat Judæus*," and we do not hesitate to avow that we participate fully in his scepticism.

James Apjohn.

CONGESTION OF BLOOD. [Hyperæmia.]—Though this term is familiar in medical writings, and in daily use among practitioners, it appears to be employed as expressing simply an acknowledged fact, rather than as referring to any pathological exposition of the phenomenon to which it relates. [It is often employed in a strangely imprecise manner, and, too frequently, it is to be feared, to shroud the ignorance of the practitioner as regards the precise pathological condition.]

Congestion of blood and determination are terms not unfrequently used to denote the same state; yet they do not signify the same thing. By congestion is implied simple engorgement of blood-vessels, without reference to any continued increase of vascular action; while determination includes the idea of the increased impetus with which the blood is propelled into the affected part. Local inflammation is perhaps the acme of this state, combining the whole three conditions; though each of the preceding may exist independently of it, and without passing into it. [Hyperæmia is, however, a precursor of inflammation in almost all, if not in all, cases.]

The subject, though undergoing much discussion in various works on pathological anatomy, is not yet sufficiently matured for the several facts and reasonings to be embodied in a special essay. The several local congestions will of course be noticed under the heads of the diseases in which they respectively occur. The general principles, so far as any are deducible from such facts as are ascertained, will, perhaps, be best understood when presented in connection with general pathology of the circulation. Simple congestion evinces over-distension of vessels, and clearly implies debility of their coats. In several tissues it seems the result rather of irritation than of pure inflammatory action. When it passes into inflammation, this seems more dependent on the general state of constitution, on the plethoric condition of the blood-vessels, with the tendency towards febrile and inflammatory excitement which this induces, than on the primary irritation, or the congestion occasioned by it. Hence congestion might be considered as passive or active; the former term applying to the simple state, the latter to that in which inflammatory action is either concomitant or superinduced.

Facts, however, are still wanted for establishing a clear and consistent theory of congestive ailments. These facts the researches of pathological anatomy, so zealously and minutely pursued at the present day, cannot fail to supply; and when sufficiently accumulated, it will not be difficult to arrange them so as, with the aid of correct physiology and sound pathology, to deduce the principles of their occurrence, and establish on a rational basis the curative treatment of the morbid condition to which they relate. The presence of internal congestions must, for practical purposes, be of course inferred from the symptoms which indicate them; and to connect the symptoms with the structural lesions which they denote, so as to furnish practical guidance in their treatment, is the proper object of medical research. This can be accomplished only by multiplied observations of phenomena, generalised by a cautious induction. An essential part of this inquiry, however, consists of a scrutiny of these modifications or changes of structure which the morbid actions occasion, and by which the effects of these can be traced on necroscopic examination. The correctness of all theory must depend on the accuracy of the facts from which it is deduced; and as no complete theory of internal congestions can be established without the aid of numerous facts derived from actual inspection of the diseased parts after death, it is of importance that inquirers should be aware of the fallacies by which they are liable to be misled in the inspection of the structures and tissues supposed to be diseased. These fallacies are displayed by M. Andral, in his elaborate and valuable work on pathological anatomy, with a minuteness and accuracy which merit the highest praise. To render any account of his laborious researches would exceed the bounds of the present article, without sufficing for that completeness which a perfect essay on congestion would require.

It may be noticed that the different degrees of colouring observed in internal parts after death, which are so often attributed to increased vascularity, and supposed to denote the pre-existence of congestion or inflammation, may result from various causes independently of disease. Of these

M. Andral specifies several; the passive hyperæmia, which has always a tendency to take place in the last moments of life in parts abounding in capillaries;—mechanical obstacles to the venous circulation, formed a longer or shorter period before death;—the hypostatic accumulation of blood in depending parts;—the transudation of blood through its vessels;—other peculiar transudations;—various gases, &c. He also remarks that differences are presented according to the part examined, the age, the period of the digestive process going on at the time of death; with other circumstances.

Unless due allowance be made for all such sources of deception in noting the effects of morbid actions, as displayed in structural lesions, the evidences afforded by pathological anatomy, though generally regarded as the most certain which medical science possesses, must be as fallacious as medical facts derived from the observation of mere symptoms and of outward phenomena are so often alleged to be. From the industry and precision, however, with which this branch of science is now cultivated, there is every reason to hope that pathological anatomy will in no long time rest on a sure and stable foundation, furnishing in the truth and extent of its facts a basis on which a firm and abiding superstructure of pathology may be ultimately reared.

The treatment of local congestions must depend partly on the nature of their site, but principally on the cause which occasions them; whether general plethora exciting increased arterial actions and determination of blood to particular parts; simple irritation inducing an increased afflux of blood by the local excitement occasioned; or mechanical obstruction causing a retardation of blood in extreme vessels, with over-distension of their coats, and preventing its free return by the refluent veins.

Each of these states must require an appropriate adaptation of remedies; for if a just discrimination be not practised in this respect, no consistency can be preserved, nor any uniformity of success be realised. If congestions result from a plethoric habit, mere local treatment can never give effectual or permanent relief; the affection recurring so soon as the local means are discontinued. With these means depletion and abstemious diet must be combined, else disappointment and further decline of health must ensue. On the contrary, if there be no plethora, and the congestion be owing to irritation only, then general depletion is not only unnecessary but injurious, enfeebling the system, and weakening those efforts by which the congestion would be naturally relieved. In both respects are errors committed. Many congestions originating in plethora are treated as local diseases until structure becomes permanently and irremediably altered; while congestions arising from irritation are occasionally confounded with inflammation, from a delusive resemblance in some of their symptoms, and blood-letting is injuriously resorted to. In no class of diseases is the former error of more frequent occurrence than in affections of the stomach and bowels. Increasing plethora begets almost necessarily a congestive state of the gastro-intestinal mucous membrane, the constitution endeavouring to throw off its redundancies by this and other outlets; secretions become increased and then vitiated; digestion is impaired; appetite declines; and a condition results to which the term *dyspepsia* is usually applied. Indigestion and loss of appetite are regarded as the disease; they are imputed to weakness of stomach, and tonics are employed; some amendment may be felt by the capillaries being excited, and the appetite may improve, but the disease is not thus arrested, nor a healthy condition restored. The capillaries may contract upon their contents, and thus abate the congestion so far as they are concerned; but it is only by repelling the blood into the vessels which led to them, and thus substituting another form of disease more mischievous and less remediable, because less within the reach of those curative processes by which the constitution so continually rectifies its own derangements. In this condition tonic treatment, subsidiary to depletory, may be and oftentimes is of service; when employed as the chief means of cure, or to the neglect of evacuants, it is invariably pernicious. The natural relief derivable from increase of secretions being arrested, the blood repelled, not only overloads the larger vessels which lead immediately to the capillaries, but becomes in time congested more distantly in several of the viscera, giving rise to diseases of various kinds.

With respect to the diseases which, arising from irritation, present appearances simulative of inflammatory action, and in which congestions often occur, much valuable information may be derived from the works of Dr. Gooch, Dr. Marshall Hall, Mr. Travers, and others, who have done much to introduce greater discrimination and accuracy into the treatment of such complaints.

[See, on the whole subject of Hyperæmia, Dunglison's *Practice of Medicine*, 2d edit. i. 520: Philad. 1844; and Dr. C. J. B. Williams, *Principles of Medicine*, § 287: Philad. 1844.]

E. Barlow.

CONSTIPATION.—The word constipation is derived from the Latin *constipo*, to crowd together, a compound of *con* and *stipo*, to fill up close. The corresponding term *obstipato*, under which costiveness is usually described by Latin authors, is from *ob* and *stipo*, to stop up, and the root of the Latin *stipo* seems to be the Greek *στυφω*, to bind as an astringent, to thicken. The true import of the word constipation, therefore, would appear to be the collecting and impacting of the excrementitious matters, the residuum of the various processes concerned in alimentation, in some part of the intestinal tube.

Constipation is not so much marked by the infrequency of the evacuations from the bowels as by their firmness of consistence, and by the occurrence of fulness and tension in various parts of the abdomen, and other symptoms indicative of impaired or impeded action in one or more of the various organs contributing towards the passage of the refuse of the alimentary process. The observations of Heberden afford so apposite an illustration of these views that we shall not hesitate to refer to them in this place:—"Homines frequentia alvum exonerandi plurimum inter se different. Alteri semel tantum singulis mensibus venter solutus est; alteri duodecies quotidie descendit per triginta annos, uti ipse mihi narravit, et dein septies quotidie per septem annos; neque vir hic interea macuerat, quin potius aliquanto habitior factus erat." It is obvious that with one of the persons here alluded to a daily evacuation would have been in fact an attack of diarrhœa, while with the other it might have been justly considered as indicative of constipation, and in either case much general disturbance of the system would probably have arisen. Similar instances, though not to so great an extent, frequently present themselves to our notice, especially amongst females, with whom the functions of the intestinal canal seem generally to be less regular than in the male sex.

Constipation has commonly been considered by writers on nosology as it occurs in persons of a lax and weak habit of body; in those of greater rigidity of temperament; and as arising from obstruction in some part of the intestinal tube. It will be sufficient for our present purpose, if we treat of it under the heads of simple constipation and constipation from obstruction, leaving the more refined divisions till we come to consider the variation produced in the symptoms by the immediate pathological state to which they may owe their origin.

Under simple constipation we mean to include those morbid affections which, without more prominent disease, are characterized by a confined state of the bowels arising from various causes so acting upon the mucous and muscular coats of the bowels as to impede the regular and efficient performance of the functions of these organs.

In accordance with these views the leading symptom of simple constipation is a costive or more consistent state than usual of the fæcal excretions, with a less frequent call for evacuation than is customary with the individual when in a state of perfect health. Other symptoms usually attendant upon this state are, more or less pain in the frontal or occipital regions, some degree of fulness and tension of the abdomen, a foul tongue, with loss of appetite, and often an undefinable sense of oppression, accompanied with corporeal languor and listlessness of mind. These symptoms are, however, materially modified by the immediate cause giving rise to the attack; and since it is of the first importance, in respect of treatment, that the relation which the symptoms and causes bear to each other should be fully established, it will be desirable to consider the variations thus induced somewhat more at length when passing the causes under review.

Causes. — 1. The first cause of constipation to which we shall allude, because the most simple in its nature, is laxity or debility of the fibre of the muscular coat of the intestines. Constipation from simple debility is not an unfrequent occurrence, and is apt to arise during the debility which attends convalescence from acute diseases. It is also observable in those who lead a sedentary life, and have a general pallid look and relaxed fibre. An opportunity of verifying, by *post-mortem* examination, the state of debility and wasting of the muscular fibres of the larger intestines, which occurs in this condition of the system, does not often arise; but the following example affords a good illustration of this lesion, and serves also to show, that without care and circumspection, the diagnosis is not always easy to be attained. A bookseller, aged forty, who led a sedentary life, had from his youth experienced great difficulty in regulating his bowels, and had constantly been using bitters and cathartics under medical advice. Latterly vomiting had succeeded to the symptoms, and he had become pale and emaciated, which induced a suspicion in the minds of his medicial attendants that he was labouring under diseased pylorus. Under this view of the case the use of active aperients was discontinued, and an attempt was made to regulate the action of the bowels by enemata, but without avail, as the attendant could never succeed in injecting any quantity of liquid into the rectum, and consequently small portions only of liquid fæcal matter were ever brought away. The patient, finding himself grow weaker, and considering that he had no hope of relief, would not consent to any examination of the rectum; and as the vomiting and constipation continued, he gradually became exhausted, and died. On examination after death, the stomach was found to contain nearly three pints of a dark coffee-coloured fluid. The mucous membrane of the organ was not redder than natural, but it was generally thickened. The small intestines were nearly empty, and were not diseased. The colon throughout its whole extent was enlarged, and its muscular fibres were thin and pale; it also contained fæcal matter and a great quantity of gas. In the descending colon and in the sigmoid flexure this was more particularly remarked, and the fæcal matter was here very hard. The whole of the rectum was enormously distended with very hard fæces. On pursuing the investigation downwards to the termination of the rectum at the anus, nothing like stricture was discovered; but the intestine was much dilated, and the muscular fibres, even near to the anus, were remarkably thin and pale. The intestinal mucous membrane did not seem to be at all diseased.

It is not often that we have an opportunity of witnessing so decided a case of debility of the muscular fibre producing constipation as this example affords; but analogous instances, in debilitating diseases, occasionally happen, where the fæces will lie for a length of time in the extremity of the rectum, without the patient having the power of voiding the accumulated hard mass, and surgical aid is sometimes necessary for its removal.

This accumulation of the fæces from debility of muscular fibre is by no means uncommon in old people; indeed we believe the existence of a weak propulsive power in the large intestines to be the most frequent cause of constipation in advanced age.

When any part of the intestinal canal has been inflamed, the care which is subsequently required in regulating the diet and in selecting the aperients necessary to keep up a due action of the bowels is familiar to every practitioner of medicine. In fact, the necessary consequence of inflammation having existed in any part is debility, and when this occurs in a hollow organ, such as the intestinal canal, we are naturally led to expect, after the acute symptoms have been subdued, a loss of power in the inflamed muscular fibre, and consequently distension of the bowel and retention of its contents. "Inflammation," observes Dr. Abercrombie, (Pathological and Practical Researches on Diseases of the Stomach, &c. 2d edition, p. 7,) "seems also to destroy the action of muscular fibre. Thus, intestine which has been inflamed is generally found in a state of great distension, showing the complete loss of its healthy muscular action; and, if the disease has gone on until the intestine has either become ruptured, or has given way by ulceration, it is found to have fallen together like an empty bag, without any appearance of muscular contraction; whereas healthy intestine, when it is empty, contracts uniformly into a round cord." The constipation, then, which arises during convalescence from inflammation of different parts of the intestinal canal, and which is so readily induced by slight irregularities of diet, is the direct result of debility of the muscular fibre, and in cases where the inflammation has arisen from obstruction, may be altogether independent of the original cause of disease, though perhaps often attributed to its continued or renewed operation. Several cases illustrative of the preceding observations will be found in the work which has just been referred to. The following affords a similar example, and at the same time shows the tendency of previous debilitating causes to produce constipation. A female servant, aged twenty-four, had miscarried about the fifth month of pregnancy, and was much weakened by profuse hemorrhage. She then had diarrhœa, which was checked by appropriate measures. Subsequently the bowels became obstinately constipated, and there was tympanitic distension of the abdomen with some pain on pressure, especially in the right iliac region. The skin was jaundiced, and there was bilious vomiting, with much depression and sunk countenance. The vomiting was checked by the application to the epigastrium of a fold of linen soaked in laudanum; but the measures employed to procure an evacuation from the bowels were unsuccessful, and the enemata administered were returned without effect, though it was ascertained by examination that the rectum contained fæcal matter. She gradually sunk, having had one copious evacuation a few hours before she died. On examination of the body, the capillary system in general was found injected with dark-coloured blood, the heart and larger blood-vessels being empty. In the abdomen, the omentum and peritoneal coat of the intestines were vascular in places, the colour of the vascular injection being more florid than in other parts of the body; and upon some portions of the small intestines circumscribed patches of lymph were found adhering to the surface of the serous membrane. Portions of the mucous membrane of the stomach, duodenum, and small intestines were also injected, and there was evident thinning of the coats of the ileum near its termination in the valve of the colon. A sac formed by the doubling of the peritoneum between the rectum and uterus was found filled with purulent matter, which was confined by recent adhesions in its vicinity. Pus was also found in the substance of the uterus near the cervix. This case was obviously one of inflamed uterus with subsequent peritonitis; but the constipation appears to have resulted from the general debility, induced in the alimentary canal by the acute disease which had previously existed there, and the remains of which were found on examination.

2. The secretions concerned in the process of alimentation may be vitiated in quality or deficient in quantity. Under these circumstances there will be a want of stimulating power in the alimentary mass resulting from their combination with the food; the propulsive powers of the muscular coat of the bowels will not be so efficiently called into action, and constipation will necessarily result. Slight changes of this kind in the nature or quantity of the secretions are of very common occurrence, and are perhaps the most frequent cause of the more trivial and temporary irregularities in the excretive function, to which every one is more or less liable. When these causes are more permanent in their action, they become of greater importance. Thus the biliary secretion is frequently disordered without giving rise to any other inconvenience than the omission or retardation of a customary evacuation; but when the morbid change is more intense in degree, or prolonged in its duration, the constipation is more marked, and inspection of the evacuations commonly shows the impaired state of the function of the liver, by deviation from the healthy colour and consistence of the fæcal matter. The evacuations will be found of firmer consistence, less homogeneous in their appearance, frequently containing portions of considerable hardness, and the colour will be pale and clayey, dirty or muddy, greenish or dark, accordingly as the bile is less copiously poured out from the biliary ducts, or so vitiated in its nature as not to preserve its usual characters. In such conditions of this secretion, in addition to the constipated and otherwise altered state of the alvine discharges, there is more or less uneasiness in the region of the liver, scarcely, however, amounting to pain; tension of the upper part of the abdomen; a moist brownish fur coating the tongue; a muddy colour of the conjunctiva, and pain of the head, usually referred to the occiput, with a sense of heaviness or oppression.

The existence of an altered state of the mucous secretions poured out from the surface of the inner membrane of the intestinal canal, and from its numerous glands and follicles, though probably of not infrequent occurrence, is much more obscure in its characters, and consequently less easily recognized. In the early stage of fever and of most inflammatory diseases there is a suppressed or diminished state of these as well as of most of the other secretions, which appears to contribute much to the confinement of the bowels occurring in such cases. And hence we have more or less of oppression at the epigastrium, with tension and fulness of the abdomen, constantly attendant upon febrile diseases. The oppression and tension of the abdomen have been referred to an inflamed condition of the stomach and small intestines; but we are inclined to question the correctness of ascribing those symptoms which are indicative merely of oppression, and are of such frequent occurrence in various febrile states, to inflammation, when the vascular fulness arising from suppressed secretions affords so adequate an explanation of the attendant phenomena. Many cases of diarrhœa, and especially such as arise from exposure to cold and wet, if closely investigated, will be found to be preceded by costiveness of some duration. In such instances one of the first links in the chain of causation appears to be a suppression of the secretions from the intestinal mucous membrane, while the general progress of the symptoms affords a striking analogy with the effects produced by a similar exposure upon the corresponding membrane of the pulmonary system. The primary effect of the exposure is in either case the same, the capillary vessels of the membrane become distended by the blood thrown into them in an increased proportion, and a suspension of secretion, producing local oppression and constitutional disturbance, is the immediate result. Should this condition not be relieved, a degree of inflammatory action is induced, which is subsequently followed by the pouring out of the altered secretions, the products of that inflammation, constituting coryza, catarrh, or diarrhœa, according as the Schneiderian, the bronchial, or the intestinal mucous membrane may have been originally acted upon by the exciting cause.

Cases of disordered digestion not unfrequently occur in which much tenacious mucus is occasionally brought up from the stomach, and it will readily be allowed that, the surface of the mucous membrane being thus covered with its morbid secretions, the customary changes cannot take place in the food, and much distress must be the necessary consequence. Such a state of the follicular and mucous secretions existing in other portions of the intestinal tube will necessarily tend to lessen the susceptibility of its internal surface to the stimulating impression of its contents, and may thus prove a cause of constipation. We have witnessed cases in which such seemed to be the sole cause of the detention of the alimentary mass in various parts of the bowels; and in these examples we have found the evacuations to consist sometimes of a mucous or muco-gelatinous substance, at others of fæcal matter mixed, or, when formed, smeared with a mucous fluid, apparently of considerable tenacity. In Dr. Abercrombie's work upon Diseases of the Abdomen there is a case, (Op. citat. p. 314,) which, as far as the state of the bowels is concerned, affords a good illustration of these remarks; and the slowness of the bowels in the following case, related by the same author, probably admits of explanation upon the views here advanced. "A lady, aged about thirty, had been in bad health for four or five months, and when I saw her was wasted like a person in an advanced stage of phthisis. She had a small frequent pulse and bad appetite, but complained of nothing except some undefined uneasiness in the abdomen. The bowels were slow, requiring the constant use of medicine; the motions were consistent and formed, but always of the deep brown colour of dark mahogany or rosewood; and no treatment had any effect in correcting that colour. The abdomen was collapsed, and nothing could be discovered by examination. Some time after I saw her, she began to have uneasiness in her chest, with slight cough; she then became liable to fits of coma, in which she lay with her eyes open, but unconscious of any thing; at length she had repeated paroxysms of convulsion, and she died in a state of the most extreme emaciation, after an illness of eight or nine months' duration. On inspection no disease could be discovered in the brain, and the lungs were quite healthy, except some very old adhesions of the pleura. The intestinal canal was throughout so thin as to be transparent like goldbeaters' leaf. On the mucous membrane there was in many places a tenacious mucus of a dark brown colour, but no disease could be discovered in the membrane itself, and no morbid appearance could be detected in any organ." (Op. cit. p. 336.)

3. Perhaps the most common cause of simple constipation of the bowels is to be found in the nature of the diet to which, in the present artificial state of existence, we are accustomed to resort. Food which is imperfectly soluble in the gastric secretions, unless of an irritating quality, must necessarily impede the process of digestion and assimilation throughout its several stages. It is unnecessary here to point out those articles of diet which come under this description; but it may be stated as a general principle, that according to the readiness and completeness with which this solution is accomplished within the stomach, except in cases where the product of the digestion is of a too stimulating or irritating nature, will be the perfection of the subsequent parts of the process, and the gradual and regular transmission of the mass through the whole course of the alimentary canal. There are, however, many substances used for food, which, after they have passed the stomach, are so little fitted for the purposes of alimentation, that they are not taken up by the absorbent vessels which open upon the intestinal mucous surface, and consequently form a part of the refuse to be propelled onwards, and ultimately rejected as excrementitious. When these substances are taken in considerable quantity, they give rise to constipation, and occasionally even to fatal obstruction from the firmness and intractability of the resulting mass. The seeds of various plants seem especially to have this tendency when taken in any quantity, and instances in which the kernels of the nut, walnut, or almond have been productive of injurious and even alarming effects, by inducing constipation and obstruction of the bowels, must have occurred to almost every practitioner extensively engaged in the duties of his profession. Two cases of fatal obstruction, the one resulting from almonds eaten in considerable number, the other from nuts, have arisen within the knowledge of the authors of this essay.

4. Increased tone of the muscular fibres of the middle coat of the intestines may not infrequently give rise to a remora in the passage of their contents, and the effect of many of that class of medicines called astringents appears to be owing to their tonic powers. It has been remarked by Dr. James Johnson, that the beneficial effects produced by travelling, on the general strength and health, are commonly accompanied by a confined state of the bowels. This is no doubt to be attributed partly to the increased activity of the absorbents, by which the alimentary mass is left in

a drier state than when the assimilating organs generally are in a more debilitated condition, but in part also to the increased tone of the muscular fibre, by which its contractions are rendered more equable, and consequently the resistance offered by one portion of the intestine to the propelling powers of another so adjusted as, by retaining the mass longer in its passage through the bowel, to co-operate with the increased tone and activity of the absorbents in extracting a greater quantity of nutriment than under other and less favourable circumstances could be obtained. Such a state is a frequent accompaniment of a healthy and effective performance of the functions of digestion, and may be considered rather as indicative of the excess of health than as requiring to be interfered with by having recourse to remedial measures.

5. Constipation is a symptom of very common occurrence in those morbid states of the encephalon in which more or less oppression is observed to exist; and in such a condition of the brain and nervous system it is probably owing to the deficiency of that influence exercised by these important parts of our frame over every organ, and in the performance of every function of the body. Usually the existence of this state of cerebral oppression is sufficiently evident from symptoms more especially characterizing it, in itself constituting the disease; but cases occasionally occur in practice in which the constipation will be found to be the prominent morbid condition, and the oppressed state of the brain not more marked than is usual; more or less headach, as we have before observed, commonly attending a confined state of the bowels. For instance, a child may have had no evacuation from the bowels for two or three days; there may be considerable fulness and uneasiness of the abdomen, with a white tongue and loss of appetite. There may also be some dulness of expression and headach. The symptoms are naturally considered to depend upon the confined state of the bowels, and appropriate purgatives are given. No action results, however, from these measures. There is oppression of the brain, and the impressions, which, under other circumstances, would have been sufficient to have excited the dormant powers, are here insufficient. If a few leeches be now applied to the head, the bowels will be almost immediately relieved. The constipation, then, in such a case will clearly have arisen from the interchange of communication between the brain and the organs of alimentation being suspended, or at least materially impeded. It is, in fact, symptomatic of a morbid condition of that organ, as in other cases it may be of a morbid condition of the liver, of the intestinal mucous membrane, or of the muscular coat; it is, however, the prominent symptom, and indeed the actual expression, of disease to be removed only by remedying the cause giving rise to it.

The obstinate constipation which occurs in connection with irritation of the spinal cord in some cases of irregular hysterical disorders, should here be noticed, since we have seen instances of young females in whom all the symptoms of obstruction of the bowels have apparently arisen from no other cause. The possibility of the symptoms arising from this cause should always be borne in mind when the patient is of the age and temperament liable to hysteric paroxysms; and where such is the case, particular inquiry should be made into the state of the menstrual secretion, and the most careful examination of the medullary column instituted, both by pressure over the vertebræ, and by drawing a sponge, which has been immersed in water as warm as can be borne, down the spine. Not unfrequently some irregularity of the periodical discharge will be discovered to exist, and some portion of the spinal column will be found tender. When such is the case, by having recourse to the appropriate remedies for this class of diseases, an apparent obstruction, which had withstood the best-directed measures, and in which the most powerful cathartics had been of no avail, will rapidly give way.

6. Another cause of confined bowels is an increase of the secretions from other organs of the body. There is an adaptation of the several functions to each other, and a relation existing among them, which, if disturbed, gives rise to many very interesting morbid affections. If any one function be either diminished, increased, or otherwise altered, some one, or perhaps all the others, will also be disturbed. Thus, if the functions of the skin be interfered with, and the perspiration be checked, we have diarrhœa not unfrequently established as a compensation, or there is an increased flow of urine to obviate the injurious effects which would otherwise be induced by the suppression of the natural secretion. Again, in diabetes, where the urinary secretion is increased, the secretions both from the skin and the intestinal mucous membrane are considerably diminished; and we have the constipated bowels, the dry glazed tongue, and the harsh dry skin, which so commonly accompany that disease. Thus, also, in cases where the powers of life are breaking up, an alternation in the state of the impaired functions may not unfrequently be observed strikingly illustrative of these views.

We come now to consider the second class of cases; namely, those in which a constipated state of the bowels is produced by obstruction to the passage of the fæcal mass through some part of the alimentary canal.

1. One of the most important causes productive of constipation by obstruction, both on account of the very precarious state in which the sufferer is often placed, and the nature of the remedies to be adopted, is the constriction of some part of the intestines in consequence of hernia. The consideration of this cause belongs more especially to surgery; but whenever obstruction of the bowels exists, careful examination of the usual seats of ruptured intestine should be made. But without producing actual obstruction, the existence of a hernia necessarily interferes with the regular performance of the functions of that portion of the intestines in which it is situated, both by inducing a tendency to lodgment of the fæcal matter in the sac, and by disturbing the peristaltic action of the muscular coat. In the treatment of constipation it will be necessary, therefore, to keep this in view, since very different measures may be required when a portion of the intestine is in such a

state, from those which would be proper under other circumstances.

2. In enteritis, colic, and ileus, constipation forms a very prominent part of the disease, and one which, independently of the morbid state giving rise to it, frequently requires much and anxious attention. The subject is amply discussed under the articles Colic and Enteritis. We should, however, observe, that it is doubtful how far those cases of colic which have been referred to obstruction arising from spasmodic constriction of a portion of the bowels are really owing to this cause. We are convinced that many of these are to be attributed to a paralysed state of portions of the muscular coat of the bowels rather than to spasm; that, in fact, the obstruction arises rather in that part of the bowels in which the fæcal mass is retained from defect of propulsive power, than from spasmodic action of the muscular fibres of the portion immediately beyond it; and the *modus operandi* of opium in such cases seems to consist in moderating the action of the propelling fibres behind, and thus affording time for the over-distended bowel gradually to empty itself of its contents, rather than in resolving the supposed spasm of the portions beyond. This explanation is likewise more in accordance with many of the causes concerned in the production of these forms of colic: thus, in the colic produced by lead, it is more consonant with the known effects of that deleterious agent upon other parts of the body, to infer that partial and irregular paralysis of portions of the intestinal canal, rather than obstinate spasmodic contractions, should result from exposure to its influence. Dr. Abercrombie's observations upon this subject, with the cases of which they are illustrative, are well worthy of attentive study, and the conclusions at which he has arrived are in strict accordance with the preceding observations. The following considerations are adduced by him as confirmatory of the view which he is disposed to take:—1. that the collapsed state in which it assumes the form of a cord appears to be the natural state of healthy intestines, as indeed of other muscular organs when they are empty, as, for instance, the bladder; — 2. that a state of uniform distension with lividity may occur as a primary disease of the intestinal canal without any appearance of obstruction, and without any part of it being in a contracted state;—3. that in ileus the collapsed parts are almost invariably found in a healthy condition, the morbid appearances being for the most part confined to the distended part; — 4. that the suspended action has continued when the obstruction below has been entirely removed, and the parts above were apparently healthy; — 5. that in a case where the application of galvanism was uniformly followed by copious evacuations from the bowels, the agent employed must have acted upon a part the functions of which were impaired, not upon one which was spasmodically contracted; — 6. that cases occur in which the state of distension arises from causes entirely of a different nature, without the peculiar contraction referred to, at the same time that there are others in which, though the disease may be traced to a mechanical cause, this peculiar contraction existed below the seat of obstruction, but could not be considered as having any influence in producing the disease; as, for instance, where there is adhesion of a portion of intestine, the regular peristaltic action of the part is impeded, and this peculiar state of contraction is found to exist below the obstructed part, though in such a case it can scarcely be supposed to arise from spasm. (Pathological Researches, &c. p. 145.)

3. But of all the causes which occasion constipation of a very obstinate nature, none are more frequent and important than certain changes of structure which occur in the large intestines, the whole course of which, commencing with the cæcum and terminating at the extremity of the rectum, is liable to various, and some of them intractable morbid affections. It will be desirable, in enumerating some of these, to enter rather more into detail than might seem at first sight to be necessary, as it will be impossible to lay down any thing like correct rules, with respect to the management of a costive state of the bowels, unless an accurate view is taken of the more obvious deviations from health in the large intestines which are connected with this affection.

The diseases of the cæcum alone are of great importance, and until lately have attracted very little attention. Looking to the structure of this portion of the intestinal canal, and considering the complexity of its mechanism, it cannot be a matter of surprise that it frequently becomes the seat of disease, and that occasionally we find the contents of the alimentary canal lodged in large quantities in this pouch. Any one who reflects on the manner in which the fold of mucous membrane projects from the ileum, and is connected with the corresponding membrane of the cæcum to form the valvular mechanism, by which a barrier arises between those two portions of the alimentary canal, must be prepared to find in this part occasional obstruction, and cannot fail to wonder that from year to year, in many individuals, the functions of this admirable portion of the human machine are performed with the utmost regularity and integrity. If it be considered, further, that where the cæcum connects itself with the colon, and for some distance afterwards, the contents of this part of the alimentary canal are propelled forward in opposition to the laws of gravity, additional reasons will appear why it should frequently happen that when the larger bowels become overloaded, the cæcum should more especially suffer.

The natural construction, then, of this part of the alimentary canal is such as to render it probable that impediments might arise to the propulsion of its contents onwards. A state of costiveness is not unfrequently connected with intestinal concretions, and these are most commonly lodged in the cæcum; and instances are recorded, where, after having been retained there for a considerable length of time, they have been discharged by the rectum. A nucleus is often found imbedded in the centre of these concretions, as for instance, some extraneous substance, which may have been accidentally swallowed, and after having passed into the cæcum, have there gradually collected around it a considerable quantity of fæcal matter; thus it is well known that pins, needles, pieces of bone, and stones of fruit, may be detained, and become the centre of alvine concretions. Upon this point much valuable information will be found in Dr. Monro's work on Morbid Anatomy, where several interesting facts are described concerning these productions, and their influence is shown in interfering with the propulsive action of the bowels, and inducing constipation.

It is of great importance to bear in mind that these concretions, as well as scybala, collect in large masses in the cæcum and colon, as a want of accuracy in distinguishing this accumulation has often been the occasion of embarrassment to the practitioner, by leading him to suspect the existence of some more important lesion in the adjoining viscera. An accurate examination of the abdomen by compression will generally enable him to distinguish the tumour which is produced by distension of the cæcum, in the right iliac region; and where this is unconnected with inflammatory action in the investing peritoneum, but little tenderness is discovered in the part. The extent to which the cæcum, on some occasions, becomes enlarged, is very remarkable. It has been found sometimes nearly equal in size to the stomach, and the pressure produced under such circumstances by its accumulated contents, has occasionally been so great that rupture of the distended bowel has occurred.

We have now been considering the least formidable of those conditions of the cæcum, which are productive of constipation; and all that is necessary in such cases for the restoration of a more healthy state of this part is, that the accumulated load should be removed. This, however, in the case of concretions, is not always an easy matter; for they are often very firm in texture, and cannot be dissolved by any medicinal agent; and even when they are dislodged from the cæcum, and carried on into the rectum, they are sometimes productive of acute pain, and a constant and ineffectual effort to evacuate the bowel by stool, and may ultimately require surgical assistance for their removal. The following case, detailed by Dr. Walker, of Huddersfield, in a communication published in the Midland Reporter, (Vol. iii. p. 236,) is worthy of attention:

"Lydia Turner, aged forty-two, had *for twenty-three years* suffered from pain in the right iliac region, with considerable tumour, which varied in size, and was larger at the time of menstruation. She was subject to great irregularity in her bowels, had frequent diarrhœa, and could part with little at once, which was as frequently followed by constipation. On January 21st, 1827, whilst carrying a can of water, she felt, as she described, something break and fall down, which was followed by immediate desire to have a motion, but nothing passed. After having had a restless night, she sent for Mr. Jubb, of Halifax, and stated she had something to part with, and that she had had pains, as strong as labour pains, all night. On examination he found a hard substance in the rectum pressing against the sphincter ani, which appeared too large to pass. It was, however, with some difficulty, removed with a pair of lithotomy forceps, and proved to be a very large, hard, and tough scybalous mass. The woman lost the pain, and had never afterwards a return of the tumour in the right iliac region."

The immediate cessation of all symptoms on the removal of the hard substance, necessarily implies that there was little or no disease in the texture of the cæcum in this case, and that the accumulation arose from want of proper propulsive action in the part. There are, unfortunately, cases where the accumulation in the cæcum is combined with considerable disease, either in the peritoneum investing this part of the alimentary canal, or in its mucous lining; either of which occurrences makes the constipation more formidable than if it arise solely from a want of proper muscular action. This is not the place to enter very fully into a description of this particular form of disease, but its frequent connection with constipation makes it necessary to place before the reader the more prominent characters which show the existence of this lesion. In addition to the tumour, which is felt in the right iliac region where the cæcum is simply distended by an accumulation of fæcal matter, there is, when its peritoneal covering is inflamed, tenderness on pressure, usually confined to the part, though not unfrequently extending more generally over the abdomen. Sometimes the functions of the bladder are affected by the contiguity of the disease, and a morbid irritability of that organ results. The constitution, also, is generally more affected; the tongue becomes white and flabby, and occasional nausea arises. If the inflammatory action extend itself to the general peritoneal covering of the intestines, there are then present the more obvious symptoms of peritonitis, under which the patient usually sinks. The following case strongly illustrates the destructive effect of this diseased action, when it commences in the peritoneal investment of the cæcum, and extends over the abdomen:

A healthy boy, aged ten years, received some months before his death a blow on the lower part of the abdomen, after which he complained of a good deal of pain in the right iliac region, and his bowels became costive. As but little importance was attached to the accident, no advice was taken upon the subject, and being at school, he allowed his bowels to remain for a length of time inactive, occasionally complaining of a good deal of pain in the abdomen. At length, after continuing for some weeks in this state, without any medical assistance, he became so ill that prompt measures were demanded. The case then presented all the appearances of peritonitis; and, more especially, the tenderness on pressure was remarked in the region of the cæcum. The most active treatment, by bleeding, general and local, large doses of calomel, the warm bath, and blisters, was adopted, but without avail; and he died in a week after medical advice was resorted to. On examination of the body after death, the abdomen was found distended; and when a section was made so as to expose its contents, a sero-purulent effusion, amounting to about eight ounces, was discovered. The omentum adhered slightly to the peritoneum. The peritoneal covering of the intestines generally seemed inflamed, and towards the right iliac region the intestines were evidently united together by the deposition of lymph. The principal disease was in the peritoneum investing the cæcum, the commencement of the colon, and the termination of the ileum. The colon and the ileum were united to each other and to the cæcum. In all of these parts the peritoneum was much thickened and injected with blood. Part of the peritoneal covering of the cæcum was ulcerated, and corresponded to an ulcerated portion of peritoneum lining the lower part of the abdominal muscles, just where the spermatic vessels enter the abdominal ring. There was a considerable accumulation of fæcal matter in the cæcum, but the mucous membrane lining this part was free from disease.

Affections of the mucous membrane lining the cæcum are likewise not unfrequently the cause of constipation. Thickening of the membrane forming what is called the valve of the cæcum, occasionally occurs, and produces obstruction to the free passage of the contents of the bowels. The following case occurred in a young lady of delicate constitution, who had throughout life been of a costive habit of body. For many weeks previous to the acute attack which seemed to be the immediate cause of death, the bowels had been unusually inactive, never indeed being moved without the use of active aperients. She often complained also of uneasiness in the right iliac region; but on examination, no particular tenderness was produced by pressure, nor was there any remarkable tumour or fulness in that part. After having taken some active doses of cathartic medicine, without any effect being produced on the bowels by them, this young lady was seized with violent vomiting and general pains over the surface of the abdomen, with considerable tenderness on pressure. Very active remedies, as copious bleeding, large doses of calomel, blisters, warm baths, were used without any relief, and she died in thirty-six hours after the severe symptoms came on. On examination after death the peritoneal covering of the bowels was very slightly inflamed; but when the mucous membrane lining the bowels was exposed, it was found extensively diseased. A great portion of the ileum showed marks of inflammatory action, and as that part of it was approached which terminates in the cæcum, considerable thickening was observed, and when the cæcum itself was opened, the whole mucous membrane lining this bowel manifested great alteration of structure. The valve of the cæcum especially was much thickened, showing that chronic inflammatory action had for a length of time been going on in that part. The diseased action extended to the mucous membrane lining the commencement of the colon, but did not proceed further.

[Of late, great attention has been paid to the inflammatory affections of the cæcum, as well as of the appendix vermiformis cæci; and much valuable information has been obtained in regard to pathological conditions, which had been previously overlooked. (See ENTERITIS.)]

It sometimes happens that without any very acute pain or other severe symptoms, a considerable thickening takes place in the membranes which compose the cæcum, and, excepting constipation and emaciation, no other remarkable change arises in the state of health. For example, a young woman, who had for the most part enjoyed very good health, became costive, and was not in her usual spirits; but not being otherwise unwell, no attention was paid to this state of things, although progressive emaciation was, after two months, added to the symptoms. She at length complained of pain in the right iliac region, and on examination, a tumour, which was tender on pressure, was discovered there. After this was known, remedies were promptly employed; leeches and blisters were repeatedly applied to the neighbourhood of the affected part; and a course of mercurial alteratives and saline aperients was combined with these remedies; but they proved unavailing, for the young woman gradually emaciated and died. On examination of the abdomen, the mesenteric glands were found to be enlarged. The stomach was healthy, and so were the small intestines. When the cæcum was examined, its coats appeared much thickened; indeed, in some parts the coats of this bowel were nearly half an inch in thickness. This was produced by a deposit of layers of lymph upon the mucous membrane. The commencement of the colon was also similarly, though not to the same degree, affected.

But thickening of a chronic nature in the mucous membrane of the cæcum is not the only pathological change of this portion of the intestinal canal which occurs in conjunction with a costive state of the bowels. The very reverse now and then happens, and this membrane becomes exceedingly attenuated, and in patches ulcerated, notwithstanding which the costive state continues, as the following observation testifies.

The subject of this case was a lady of a delicate constitution, who was about forty years of age. She through life had been a victim to the most obstinate constipation, and had suffered so much from this cause, that she had for years been in the habit of taking daily aperients; at the same time that the most drastic purgatives, which had often been given, had occasionally failed in producing the desired effect. Her last illness commenced with severe vomiting, accompanied by acute pain in the epigastric region, and complete inactivity of the intestinal canal. In despite of all remedies that could be applied, the vomiting and constipation continued. She lingered many weeks in this state, gradually emaciating, and rejecting every kind of nourishment. She continually referred to the epigastrium as the only seat of uneasiness; and as there was no tenderness on pressure of any part of the abdomen, the sense of sinking at the pit of the stomach and the continued vomiting led the medical attendants to suspect that there was disease either in the stomach or the duodenum. Not a suspicion was ever entertained that the cæcum or any part of the larger intestines was the seat of disease. On examination after death, the stomach and duodenum were found perfectly healthy. The small intestines were empty: the peritoneal covering of the ileum seemed redder than natural. The mucous membrane of the small intestines was healthy. In the cæcum the mucous membrane displayed a very curious alteration of structure: it was of a very dark colour, and had become very thin, so that the muscular coat of the bowel was readily exposed. In one part the membrane was ulcerated for the size of a bean. At the commencement of the colon the mucous membrane was of a dark colour, and as thin as gold-beaters' skin. The least touch separated it from and exposed the muscular coat of the intestine. This condition extended for about a foot, when the mucous membrane was observed to be thickened, and appeared inflamed, and in patches ulcerated. The inflamed and thickened state of the mucous membrane with occasional ulceration continued until the colon terminated in the rectum, which latter throughout its course from thence to the anus seemed to be free from any disease. The large intestines throughout were loaded with hardened fæces. The liver was not quite healthy; it had a nutmeg appearance, and its texture was less firm than natural. The spleen and pancreas were healthy.

There is much reason to believe that affections of the cæcum producing constipation, have been frequently mistaken for diseases of other organs, and certainly for none more commonly than for diseases of the liver; an organ which, for a long period, was regarded as the fruitful source of all abdominal disorders, whilst the affections which arise in the course of the alimentary canal itself were much neglected. The functions of the cæcum are likewise liable to be interrupted by any deviations from health in the contiguous parts, whereby the propulsive force may be so deranged as not to transmit the fæculent mass from the small to the large intestines; for if the neighbouring viscera are only slightly altered in their structure, the passage of the contents of the bowels through the valve may be materially impeded, if not altogether obstructed. The part which is more especially liable by its derangement of function to impede the propulsive action of the cæcum is the colon, particularly the ascending portion, and the transverse arch.

Simple want of propulsive power in the colon is sufficient to cause accumulation in this bowel; and when the ascending portion and the transverse arch become thus distended with fæces, the pressure upon the liver occasionally so interferes with its functions, that the diseased condition may, without care, be mistaken for hepatitis itself. The pressure upon the *ductus communis choledochus* induces an icteric appearance, and there is even, at times, uneasiness and fulness in the right hypochondrium. Constipation is of course the result, and the cæcum suffers distension and consequent disease. We cannot, however, at all times, under these circumstances, discover any tumour in this part, as the enlargement must be considerable before it can be ascertained by external examination. An erroneous judgment, therefore, may readily be formed; and the affection, which is arising simply from the distension of the colon and cæcum, may be mistaken for enteritis or hepatitis, or even nephritis; for it is by no means uncommon for the urine to be scanty and very high coloured, and for pain to extend up the right side of the loins and to the region of the right kidney. But under such circumstances, the constipation continuing, and the fæces being pent up in the colon and cæcum, much irritation is of course excited, and long-continued disease of the mucous membrane of these parts may be thereby induced; for the secretory glands of this part of the colon being necessarily obstructed, chronic inflammation may be produced in them, and thickening of the coats of the bowel to a prejudicial extent eventually ensue.

Other and more serious organic affections may also result from this disposition to constipation, and from the disease of the mucous membrane connected with it. Ulceration may arise, or, what is more common, a portion of this large intestine may become contracted, and thus oppose a permanent obstruction to the free passage of the contents of the alimentary canal. Examples are not unfrequent, and the following instance may be sufficient to adduce. A labouring man, aged forty, had been for many months liable to constipation. His bowels occasionally would not be moved for a week, and he had been subject to an appearance of icterus when the constipation was most urgent. During the paroxysms of pain, which often came on when the bowels had been some time confined, he writhed about in great agony, and the pain was generally accompanied with violent vomiting. When, at length, by the assistance of enemata and active aperients the bowels were acted upon, a very large quantity of fæcal matter usually passed away, and it was often of a pale colour. In this case there was not any tenderness in the right iliac region, nor was there any tumour to be discovered in that situation. The patient, however, was a corpulent man, and the examination was thus rendered more difficult than it would otherwise have been. After various paroxysms of the nature above described, and from which he had been recovered by enemata and aperients, he died in very great suffering, apparently exhausted by the frequent recurrence of vomiting and pain. On examining the abdomen there was not discovered any disease of the peritoneum; the liver, spleen, and pancreas were likewise healthy. The stomach also and the small intestines were not apparently diseased. The cæcum was enlarged, and contained a large quantity of fæcal matter. At about three inches from its commencement the colon became very much contracted, and for nearly an inch in length it had a scirrhous appearance, and when a longitudinal incision was made in this part, the coats of the bowels had a cartilaginous feel. The caliber of this part was so much narrowed that the little finger could scarcely pass through it. No other alteration of structure was discovered in any part of the larger intestines to the termination at the anus.

It is worthy of remark, that a stricture of any portion of the colon may exist for a series of years, and the only result observable from it shall be an habitual state of constipation, which, after the occurrence of paroxysms of severe pain resembling colic, may end by abundant and relaxed stools, into which state of softness it appears to be, under such circumstances, necessary that the alimentary mass should be reduced before it can pass freely from the bowels. After such a state has continued for years, and a costive condition of the bowels has been almost habitual, an opposite state occurs, and a tendency to diarrhœa constantly prevails. There is reason to believe that this change in the condition of the bowels, where constipation has been long kept up by a stricture in any portion of the colon, sometimes arises from ulceration taking place in the constricted portion of the intestine, by which means a more easy transit is afforded to the contents, and a greater degree of irritation of the mucous membrane lining the bowels is produced. The following case strikingly exemplifies this circumstance. A gentleman, aged sixty, had for more than twenty years been troubled with habitual constipation and occasionally colicky pains. After a severe cold, which very much affected the bronchial membrane, and from which he with difficulty recovered, the condition of the intestinal evacuations became very much altered, and, instead of being costive as they formerly were, always of a liquid nature, two or three motions occurring daily. Under this increased evacuation from the bowels he became thinner and weaker. His tongue also continually showed a morbid incrustation, and the skin was dry and rough. The most careful examination of the abdomen could not discover any unnatural tenderness; and although he occasionally complained of griping pains, it was not very common for him to do so. The relaxation of the bowels continued for many months, and he sensibly declined in flesh and strength. At length, after an unusually severe attack of diarrhœa, which was also accompanied with hemorrhage from the bowels, his life fell a sacrifice to this prolonged disease. On examination of the abdomen, the peritoneum generally appeared free from disease, excepting at one part, where the arch of the colon was adherent to the edge of the liver. The stomach and small intestines were healthy; the mucous membrane lining the cæcum as well as at the commencement of the colon was healthy; but near the transverse arch it bore marks of inflammatory action, and when the investigation was pursued to that part of the colon which was adherent to the liver, a large ulcer was discovered, surrounded by very hard edges. The ulcer extended nearly through the circumference of this part of the intestine, and the intestine itself was contracted for half an inch, as is customary in scirrhus. The mucous membrane of the colon, extending onwards to its sigmoid flexure, was a good deal inflamed. It may be inferred that the habitual constipation which marked the life of this gentleman for twenty years, was owing to the contraction of the colon, and which was only succeeded by some months' diarrhœa, when ulceration had so destroyed a portion of the contracted part as to render the passage of the contents more easy, and when in consequence a greater degree of irritability had been given to the whole course of the large intestines.

But it is not either in the ascending portion or in the transverse arch of the colon that alterations of structure, producing constipation, are most frequently brought under our notice. It is at its sigmoid flexure that this intestine seems more especially prone to fall into a state of disease. Spasmodic stricture, in this part, appears often to arise and to be the cause of constipation. On examining bodies after death, the tendency to contraction of this portion of the alimentary canal has been frequently observed, and where this tendency exists to any great extent during life, it must prove an obstacle to the free transmission onwards of the fæces contained in the arch of the colon. But in addition to this very common state of contraction of the sigmoid flexure of the colon, it appears to be correctly ascertained that organic stricture of the intestines is more frequent in this part than either in the ascending portion or in the arch of the colon. If, indeed, we attend to the annals of medicine, and consider the many instances there are on record of this form of disorganization in this portion of the alimentary canal, we are compelled to admit that it is not an unfrequent cause of obstinate constipation. At the same time it should be observed, that in proportion as organic constriction approaches the exit of the bowels at the anus, so does it become more easily investigated by external means; and, consequently, as a cause of constipation, it is more frequently ascertained when it occurs in the sigmoid flexure of the colon than when it is produced in the ascending or transverse portion. For in addition to the signs depending upon the disturbance of the intestinal action which direct us in this as well as in other intestinal affections, we have it also in our power, in this instance, by passing bougies and flexible tubes, to become tolerably certain of the diseased state into which the intestinal tunics have degenerated, at least when the scirrhous condition is so far advanced as to produce any extraordinary obstruction to the transit of fæcal matter. It is true that this investigation may not be very easily made by those who hastily come to a conclusion with respect to the state of their patient; yet the anxious inquirer after truth, although not always able to cure the affection, may have the satisfaction of discovering the cause of the constipation, and of laying down such a plan as may materially alleviate the suffering, and for a time at least arrest the fatal termination. There is nothing novel in cases of this kind, but still it is not amiss to impress the mind with striking facts which bear directly upon any subject under consideration, and the following example seems very much to the purpose. A gentleman, aged fifty-eight, who had for many years been in the East Indies, and was of a full habit, and what is commonly called a strong constitution, became, after his return from India, liable to constipation, for which, during the space of two or three years, he was in the habit of taking aperient medicines. At length the constipation assumed a more serious aspect, for it became very difficult to move the bowels excepting by the exhibition of very active cathartics; indeed, so obstinate did they become, that they resisted altogether ordinary measures, and in consequence vomiting and distension of the abdomen came on. He was treated as for enteritis, by bleeding, warm bath, calomel, and castor oil, and enemata were administered. He recovered under these measures, but it was only to suffer at the end of a short time a recurrence of the symptoms. The same remedies then failed to relieve him, and the common form of enemata returned without any quantity of fæcal discharge. It was at this juncture that it was thought desirable to ascertain whether, by introducing a hollow tube into the colon, and by injecting warm fluids into it, any beneficial effect might result, and whether any obstruction might thereby be discovered.

in the sigmoid flexure. No obstruction was experienced within ten inches of the anus; but at about twelve inches there seemed to be a difficulty in passing on the instrument. A considerable quantity of fluid, however, was injected into the intestines, and it was happily followed by a free evacuation of their contents. The patient from that time again recovered, and by the habitual use of gentle saline aperients, and the daily injection of warm fluids into the colon, he was for several months kept in a very comfortable state, and enjoyed very tolerable health; fatal obstruction, however, in the end took place, and he died about a year after the attack before-mentioned. On examination after death, all the viscera of the abdomen were quite healthy, excepting the cæcum and colon. The cæcum showed marks of much distension, and its coats were thickened, and the mucous membrane lining this part was inflamed and thickened. There was nothing worthy of notice in the ascending portion or transverse arch of the colon; but in the sigmoid flexure, not far from the rectum, there was a very remarkable narrowing of the intestine. For the space of half an inch the coats of the bowel had here become scirrhous and cartilaginous, and ulceration was commencing in the inner portion. The colon and cæcum were much loaded with fæcal matter.

But without any particular contraction occurring in any one portion of the large intestines, it sometimes happens that habitual constipation is accompanied with a general thickening of the mucous membrane lining the cæcum and colon, and the sigmoid flexure of the colon is more especially the seat of this alteration of structure. The means of investigating this state of the large intestines do not often occur, as, unless some other disease be connected with it, fatal effects seldom result. A lady, aged forty-five, who died of cancer of the breast, had always been of a very costive habit of body, and had latterly never been moved without the aid of aperients or enemata. She had occasionally suffered very much from pains of the abdomen and griping, and when the bowels were much constipated had been subject to attacks of vomiting. Death took place apparently not so much from this state of the bowels as from the exhaustion induced by the cancerous affection. On examination of the body, the stomach and intestines as far as the sigmoid flexure of the colon were healthy, but from that part to the middle of the rectum there was considerable disease. The mucous membrane was thickened and highly vascular, and the inflammatory action had extended to the other coats of the bowels, and the peritoneum covering that part of the colon was found adhering to the contiguous parts. The thickening and adhesions seemed to be of long standing.

4. Numerous, however, as are the instances in which a costive state of the bowels is produced by disease in the cæcum and colon, they are not so frequent as those which arise from affections of the rectum. The structure and functions of this part of the intestinal canal, and its contiguity to important viscera in the pelvis, in some measure account for this. "The rectum," observes Mr. Chevalier, "commences from the colon, close to the last vertebræ of the loins, and passing down into the hollow of the sacrum, it takes the curvature of that bone, in which it lies comparatively loose, invested anteriorly, but not posteriorly, by the peritoneum. When it reaches the os coccygis, it quits the peritoneum entirely, and is connected loosely by cellular membrane with the bladder, in the male, and the vagina in the female, with the muscles of the perineum, with the levatores ani, the sphincter ani, and the common integument. This lower portion of the rectum is easily distensible; but while it is in a natural state, the peculiar sensibility of its internal surface speedily excites it, when moderately distended, unless the fæces are unnaturally hard, to expel its contents, and its muscular fibres are competent to enable it to do so, with a very moderate assistance from the action of the abdominal muscles. It is needless to say of how much consequence it is to the general health that the sensibilities of this important organ should remain unimpaired, and that strict attention should be paid to the regular performance of its functions; if this be long neglected, its natural sensibility becomes gradually diminished, it will remain overcharged for an undue time; the energy of its muscular fibres will become impaired; so that a more forcible exertion of the abdominal muscles will be required to expel the stools, and not unfrequently this will often be insufficient, without some medicine be taken to quicken the action of the bowels." (Medico-Chir. Transactions, vol. x. p. 402.)

The morbid affections we shall notice as occurring in the rectum, so as either to cause or increase the constipated condition of the bowels, are, relaxation of the rectum, stricture of the rectum, hæmorrhoids, and spasmodic contraction of the sphincter ani.

Relaxation of the rectum is not unfrequent in delicate children, in whom, when the bowels have been for some time in a very irregular state, the rectum is often found to become prolapsed, apparently from the want of a due degree of contractile power in the muscular parts of its lower portion. This form of relaxation of the rectum is very common; but there is another which is not so open to observation, and which has consequently often been passed without being noticed. It exists sometimes without any external protrusion of the bowel, for the whole of this portion of the intestinal canal becomes much distended, whilst the colon, and the rectum itself above the distended part, retaining their contractile power, the upper part of the rectum sometimes falls down within the lower, constituting what may be termed an internal prolapsus. The harmony of action between the upper and lower part of the rectum being thus destroyed, the stools are expelled with difficulty in small irregularly-shaped pieces. The difficulty thus occasioned becomes a source of considerable irritation to the lower part of the rectum, and tenesmus, with ineffectual straining, leads to distension of the hæmorrhoidad veins and increased secretion of mucus from the intestine. The parts adjacent do not fail to suffer from this disturbance: in men, the prostate gland and neck of the bladder become affected; and in women uterine irritation and frequent micturition are the result. In other instances the rectum becomes dilated to an almost incredible extent, and the whole pelvis filled with fæces; whilst, at the same time, little or no effort is made by the bowels to discharge this extraordinary accumulation. This state of the rectum is most commonly observed in females, and in those whose sedentary occupations lead to a neglect of those measures necessary to ensure regularity of the functions of the intestinal canal.

Stricture of the rectum is, doubtless, a much more frequent disease than, until within these few years, it was supposed to be. In all cases of constipation of long duration, the state of this part of the intestinal canal should be particularly examined, with a view to ascertain how far it is connected with stricture. Mr. Salmon, in his late Essay on Stricture of the Rectum, considers this bowel as composed of three portions; the first, or upper portion, extending from the termination of the sigmoid flexure of the colon half way to the anus, and having its concavity forwards; the second, or middle portion, extending to the prostate gland, and having its concavity upwards; the third comprehending the last two inches of its course, and having its concavity turned slightly backwards; and he is of opinion that stricture always occurs at the junctions of the upper and middle, or of the middle and lower of these component curves of the rectum with each other, or at the point where the upper curve unites with the sigmoid flexure of the colon. Its most frequent seat appears to be at the junction of the upper and middle curves, five or six inches from the anus, and consequently beyond the reach of the finger. The next most frequent seat is where the sigmoid flexure of the colon terminates at the rectum; and it is least frequently found in the immediate vicinity of the sphincter ani.

Many symptoms are written down in books as attending upon a contracted state of the rectum, but little dependence can be placed upon these as being always present; and with the exception of constipation, we cannot rely with confidence upon any. It cannot, therefore, be too often repeated, that when costiveness exists habitually, the state of the rectum should be closely examined, For it has been clearly proved by the labours of Sherwin, Mossman, Home, Copeland, White, Howship, and Salmon, not only that scirrho-contracted rectum,—a disease, the carcinomatous malignity of which but too surely defeats the best-directed attempts of the practitioner to save the life of the sufferer,—is of not infrequent occurrence, but also that much more often stricture of the rectum may arise from other causes of a far less serious nature, which by skilful management admit of cure or alleviation. It seems now to be pretty generally conceded, that stricture of a spasmodic nature, not dissimilar to spasmodic stricture of the urethra, may arise in the rectum, and, if not judiciously managed, may lead on to thickening and induration between the muscular and villous coats. Even in this stage, however, the suffering may be considerably alleviated; and when the disease arises from causes of an accidental nature, as the irritation of drastic purgatives, it may be altogether removed. Should it originate even in some defect of structure, as from narrowness of the sigmoid flexure of the colon, or from unusual prominence of the superior part of the sacrum, still the practitioner may hope to afford some alleviation of the costive state, by bearing in mind the cause upon which it depends.

Habitual costiveness, then, being the most constant effect produced by a strictured state of the rectum, we need not dwell here on the sense of fulness, which is said generally to be felt in the transverse arch of the colon, and especially towards the sigmoid flexure of that bowel; on the sense of pressure, and sometimes acute pain with violent spasmodic contractions near the same part; on the uneasiness felt on going to stool, attended with difficulty in voiding the fæces; on the sensation of tenesmus and uneasiness still continuing after the evacuations; or on the changes in quantity, size, and figure induced in the evacuations.

We must not allow ourselves to be lulled into a false security by the stools not having an irregular figure, and not being in small quantity at a time; for Mr. White very justly remarks, "if the stricture should happen to be so low in the rectum as not to allow room for the accumulation of the fæces, it must appear evident that they will be found uniformly small in diameter (in proportion to the degree of stricture,) while they continue to be discharged in a figured state. And also, when the stricture is high up in the rectum, so long as the gut below retains its natural expulsive power, an accumulation will be prevented, and the diminished size of the fæces will continue.

But as the disorder increases, the inferior portion of the intestine gradually loses that power; and when the contraction becomes considerable, a small quantity of fæces only passes at a time through the stricture, and being insufficient to stimulate the lower part of the rectum, which in a great measure is deprived of its natural action, an accumulation goes on from time to time, until at length it becomes difficult to remove; and on these occasions fæces of a natural size are oftentimes discharged."

In the costiveness which depends upon mechanical obstruction of the fæces in their passage through the rectum, we have before observed that pains of a spasmodic nature in the course of the colon occur; and there is also often a sensation as if a cord were tightly tied around the abdomen. The great distension to which the colon is occasionally subjected from the accumulation of fæces, owing to the costiveness produced by the strictured state of the rectum, may explain these distressing feelings. The enormous extent to which the colon becomes dilated, in some instances, in consequence of this mechanical obstacle to its passing forward its contents, is truly astonishing. Its circumference, under such circumstances, has been found, throughout its whole course, equal to that of a stomach of the full size, and the muscular fibres and longitudinal bands proportionably increased in size.

It is usually in cases where the costiveness has been in existence for a very long period that the colon is found so enormously distended, and when stricture of the rectum has proceeded gradually, and has at length arrived at so aggravated a state that scarcely any fæces can pass through the contracted part, that this dilated condition of the colon is most remarkably developed. The following case occurred some years ago at the Worcester Infirmary. The patient, Elizabeth Stockall, was for three or four years the victim of stricture in the lower part of the rectum, which was sufficiently near the sphincter ani to admit of her being relieved from time to time by dividing the stricture with a bistoury; and for two years the accumulated fæces arising from the costiveness were, as it became necessary, removed either by a division of the stricture, or by the use of glysters. She never complained of much pain down at the strictured part of the rectum, but very often in the direction of the sigmoid flexure of the colon. There was in this case so little contractile power in the rectum below the stricture, that the fæces passed by little and little through the contracted part, and accumulated in large quantities in a pouch below the contraction, and it was necessary to wash this accumulation away by the repeated use of clysters. At length, the strictured part would no longer admit of the passage of any fæces, and stercoraceous vomiting took place, soon after which her existence terminated. On examination of the abdominal viscera, the first thing that claimed attention was the arch of the colon distended to the size of a large stomach, and completely concealing the small intestines. On further tracing the colon, the dilation of it was found to be equally great from the cæcum to its termination in the rectum. The sigmoid flexure of the colon was displaced from its usual situation, and lay across from the left to the right iliac region. The rectum also, from its commencement to the strictured part, near the anus, was equally distended. The fæcal matter contained in the cæcum was hardened, but that in the colon and rectum was soft and pultaceous.

Numerous, then, as are the instances in which costiveness depends upon stricture of the rectum, we must again revert to the importance of attentive examination of this part in habitual costiveness; for although additional symptoms often unequivocally point to this lesion when it exists, as in the above examples, in a very marked degree, yet there are instances in which, with the exception of costiveness, no symptoms point to this diseased state of the bowel, and the practitioner cannot have this important truth too strongly impressed upon his mind,—that *actual examination* by the finger or bougie, after the fæces have been evacuated, during which the patient should make an effort as if to go to stool, is the only means of detecting this disorder.

Hæmorrhoids have an intimate relation to costiveness. This affection, in its commencement, appears generally as a determination of blood towards the rectum, recurring periodically and irregularly, and may be produced by any cause which interrupts the free return of blood from the rectum. The pressure of fæces habitually retained in this bowel is, consequently, one of the chief causes from which this troublesome affection arises. It would be deviating from the subject of this article to enter into any lengthened statement regarding the pathology of piles; neither is it necessary here to enter at any length into the inquiry, whether they are to be generally regarded as merely a topical affection. Dr. Cullen was of opinion that the disease is purely local, and his reasons for so considering it were, that piles take place before the period of life at which a venous plethora happens; that they frequently arise in females in whom a venous plethora determined to the hæmorrhoidal vessels cannot be supposed to occur; and that they happen to both sexes, and to persons of all ages, from causes which do not affect the system, and which are manifestly suited to produce a topical affection only. According to Martinet, "piles appear under the form of tumours, varying in size and more or less thickly set, arising from the dense cellular tissue which connects the mucous to the muscular coat, contained in a sort of cyst, thin, smooth, or sometimes villous in its interior, and adhering by its external surface to the submucous cellular membrane. In many instances these tumours are formed of a reddish vascular spongy tissue, or of a sort of parenchyma or fungous flabby tissue, analogous to the erectile. Sometimes they depend upon partial dilation of the veins, which may be easily proved by the introduction of a probe into the vessels."

Mr. Calvert, in his practical treatise on hæmorrhoids, makes a very proper distinction between the two kinds of hæmorrhoidal tumours, viz. the firm fleshy, tubercular masses which form the proper and genuine piles, and the dilated vein or hæmorrhoidal varix, which essentially differs from the former in morbid structure. It is scarcely necessary to point out the importance of a cautious examination of these tumours when they arise in persons of a costive habit of body. Their frequent connection with stricture of the rectum, with diseased uterus, with diseased prostate gland, and with prolapsus ani, all force upon us the necessity of carefully investigating all the circumstances arising in or near the rectum which may exert any influence in keeping up the costive state. (See HÆMORRHOIDS.)

The fact is incontestable, that piles are not only a common effect of constipation, but that they likewise frequently themselves become a cause of aggravating the previous inactive condition of the bowels. This manifestly arises from their offering a mechanical obstacle to the descent of the fæces; for by their number and magnitude they sometimes block up the lower part of the rectum. At the same time it is also by no means uncommon for these tumours, by their long continuance or frequent recurrence, to produce considerable thickening in the cellular membrane which surrounds the lower part of the rectum, and in this way materially to interfere with the action of the sphincter ani. Persons who suffer from hæmorrhoids are very subject to prolapsus ani; and the thickening which occurs in the cellular membrane near the anus often increases the uneasiness that arises from this cause. In the common accident of falling down of the lower part of the rectum, this bowel is generally soon replaced; but if there be thickening of these parts, an unyielding ring is sometimes formed which does not readily return, a circumstance which sometimes operates very unfavourably as an obstacle to the evacuation of the rectum. It must also not be forgotten that internal piles occasionally occur from the enlargement of the veins higher up in the rectum, and there offer a mechanical obstruction to the passage and discharge of the fæces.

But there is another mode in which piles may prove a cause of constipation,—by *spasm of the* *sphincter ani.* These tumours are liable to become inflamed, and when they are so, the sensibility of the mucous tissue surrounding them is greatly increased. This is propagated to the sphincter ani, and sometimes violent contraction of this muscle takes place, and thus spasm of the sphincter ani, by impeding the evacuation of the rectum, becomes an occasional cause of constipation. The office of this important muscle is, so to close the extremity of the rectum as to prevent the escape of its fæcal contents, unless when a voluntary effort is made for that purpose. But under some circumstances of increase of the sensibility of the mucous surface lining the lower part of the rectum and the verge of the anus, this muscle sometimes becomes spasmodically affected, or contracts with too much power, and in this manner offers a barrier to the evacuation of the rectum. When this condition arises, it requires a more than ordinarily powerful voluntary effort to pass the fæces; and if they happen to be hardened and in large quantity, the evacuation is with great difficulty, or not at all, effected.

Spasm, however, and increased action of the sphincter ani may exist without our being enabled to detect any inflammatory or other local affection likely to call it forth, and thus may become in itself a legitimate cause of constipation. In delicate females of high sensibility, and who are of the idiosyncrasy usually called nervous, it is not unusual to observe obstinate constipation, the fæces being retained in the rectum, On examination of the rectum we may fail to find any local cause capable of accounting for this effect, excepting a highly spasmodic state of the sphincter ani. In such cases the vehemence with which this muscle contracts on the slightest stimulus being applied to it is so great, that it is often with difficulty that, for a time, even the tip of the finger can be passed within its circumference. In short, the sphincter seems to partake of the increased mobility which characterizes the general system. When, however, such a state takes place, it must obviously oppose an obstacle to the passage of stools from the rectum; and we need not, therefore, further insist on the necessity, in all cases of nervous excitement, of taking the spasmodic affection of the sphincter ani into consideration, when endeavouring to obviate habitual constipation.

We have now passed under review the principal causes existing within the alimentary tube or in immediate connection with its functions, which concur in producing a constipated state of the fæcal discharges; and we have only further to offer a few observations respecting those causes which may be termed external or adventitious, to conclude this part of our subject.

Among the most important of these are tumours existing in various parts of the abdomen, which, by their pressure upon different portions of the intestines, frequently obstruct the passage of the fæces. When these tumours are of considerable size, they may in general be readily detected, and their connections by a careful examination to a certain extent ascertained. Those existing in the neighbourhood of the rectum, sigmoid flexure of the colon, and cæcum, are most likely to produce constipation. It is, however, in cases in which, in consequence of inflammation, adhesions and connections of portions of the intestine have been formed, that obstruction of the bowels generally occurs. These adhesions may be such as materially to impede the ordinary and regular progression of the fæces by interfering with the vermicular action of the muscular coat of the bowel, or they may be such as to produce complete obstruction by the constriction and pressure induced. The following case affords an illustration of these observations:—A woman of middle age, the mother of several children, had a tumour occupying nearly the whole of the abdomen, in which fluctuation was distinctly perceived. The urine was scanty and turbid, and there was much constitutional disturbance. Digitalis and other diuretic remedies were employed with the effect of inducing a free discharge of urine and the rapid subsidence of the tumour. Some months afterwards the swelling had partially returned, and the bowels had become constipated. The abdomen was now found irregularly tumefied and painful on pressure, but not much enlarged; and at this period fluctuation could not be satisfactorily made out. There was, however, obstinate constipation, vomiting, quick small pulse, shrunk countenance, and prostration of strength. She lingered some days in this state, but no means which could be employed produced any effect upon the bowels. On inspection both ovaria were found to be enlarged; the left was not much larger than a full-sized orange, but the right ovarium occupied nearly the whole of the lower part of the right side of the abdomen, and upon being opened was found filled with fæcal matter. The intestines and other abdominal viscera were so agglutinated together that it was impossible to trace any portion of them, but it appeared that the communication which had formed between the right ovarium and the large intestine was at the spot where from the pressure complete obstruction must have been produced.

The importance of instituting an examination of the rectum in all cases of obstinate constipation has already been fully insisted upon. In the thirty-first volume of the Edinburgh Medical and Surgical Journal, a case is reported by Mr. Alexander, of Wooler, which, at the same time that it affords a singular and interesting example of obstinate constipation caused by the pressure of an enlarged and scirrhous uterus, forcibly shows the necessity of careful examination wherever there is any difficulty in tracing the constipated state to its cause. "The patient, a woman who had been labouring under habitual and in the present instance obstinate costiveness, stated that for a long time past she had had great difficulty in voiding her stools, which were always passed in small quantity, and very much flattened. Upon examination per anum the obstruction was found to be produced by an enlarged and indurated uterus mechanically compressing the rectum against the upper part of the sacrum. At a little distance from the anus a part of the scirrhous mass could be felt of a pyriform shape; and after the finger was carried over this, a still larger projection could be discovered extending backwards and upwards, and partially occupying the hollow of the sacrum; beyond this neither the finger nor any instrument could be passed. The coats of the rectum appeared perfectly sound, and could be made to slip backwards and forwards over the surface of the tumour, indicating that, as far as the finger could be passed, there existed no adhesion between them and the morbid parts. The os uteri examined per vaginam was considerably dilated. Its lips and the inner surface of the cervix, so far as could be felt, were thickened and of a cartilaginous hardness. By introducing the fore-finger of one hand into the rectum, and of the other into the vagina, a considerable portion of the indurated mass could be as it were embraced between them, which could thus distinctly be felt to involve almost the whole substance of the womb." The passage was kept open for a few days by rendering the fæces liquid, but in the course of little more than a fortnight the obstruction became complete, all measures made use of to remove it being of no avail. In this state she lived nine weeks, during which time she suffered much from paroxysms of severe pain and from sense of distension. At the expiration of this period, probably from some change having taken place in the tumour, violent diarrhœa came on, under which she ultimately sunk exhausted. No inspection could be obtained. (Edin. Med. and Surg. Journ. vol. xxxi. p. 220.)

A similar effect upon the function of defæcation may be produced by displacement of the uterus—a morbid condition which, although not strictly speaking a tumour, yet by the unnatural pressure which it occasions upon the bowel, may act precisely in the same manner in obstructing the passage of its contents. An example of this kind is narrated in Hufeland's Journal, by Dr. Pitschaft, of Baden, and quoted by Dr. James Johnson in a late number of the Medico-Chirurgical Review:—"A woman who had passed through several difficult labours, suffered for three months (during which time the catamenia were absent) from various distressing feelings in the abdomen, and at length from a retention of urine and from a most obstinate constipation. The urine was discharged only by drops, and the use of the catheter was therefore required. For the space of twelve days no evacuations from the bowels could be procured, although all sorts of purgative medicines had been tried, and the distress of the patient was extreme from an almost constant tenesmus, complete loss of appetite, nausea, and a tympanitic distension of the belly. Dr. Pitschaft was summoned to her relief; he at once suspected the existence of a retroversio uteri; and his suspicions were verified by a vaginal examination. The uterus was easily replaced, and anodynes and gentle aperients soon restored her to perfect health."

Other causes productive of constipation by pressure upon the bowels from without might be enumerated, but it will be sufficient in this place briefly to allude to diseases of the spinal column and undue prominence of the upper part of the os sacrum. Either of these causes may be instrumental, under certain states of the alvine discharges, in producing constipation. When the distortion induced by disease of the spine is considerable, the narrowing of the pelvic orifice which occasionally occurs is such as very materially to interfere with the propulsion of the fæces through the lower bowel, and accumulation in the sigmoid flexure and descending portion of the colon is a necessary consequence. The projection of the sacrum may also occasionally act in a similar manner, namely, by narrowing the pelvis, and thus impeding the passage of the fæces from the lower portion of the colon into the rectum. It is necessary to keep these causes in mind, since in every case the degree of relief afforded must necessarily in a great measure depend upon a correct estimate being formed of the morbid condition from which the symptoms take their rise.

Treatment.—Perhaps there is no variation from the state of health to which the human frame is liable, in which the importance of correct rules of practice is less understood and appreciated than that under consideration, and certainly none in which the habitual comfort of a large proportion of the community is more intimately concerned. The annoyance arising from the constant necessity of taking aperient medicines is only to be conceived by those who have in their own persons experienced it, or have been in the daily habit of witnessing it in others. The habitual use of strong cathartics, the necessity for which is often induced by the practice of taking them, affords in but too many instances most forcible illustrations of the evil effects of empiricism, various instances of organic disease of the stomach and intestines being manifestly derived from their employment. We can scarcely therefore estimate too highly the importance of establishing those principles which may lead to a more correct mode of treating, not only the severe forms of constipation, but those minor degrees of this affection which, arising from various causes, are of daily occurrence, and require for the most part much care and attention to rectify. In the observations which follow we purpose to pursue the same divisions of the subject by which we have been guided in the preceding part of this essay; and by pointing out the relations existing between the various morbid conditions giving rise to this functional disturbance and the general principles of treatment applicable to each, we hope to lay down such rules as may prove serviceable in the management of a class of diseases which every practitioner will find to be of nearly equal extent with the practice in which he is engaged, and the correct treatment of which involves the comfort of almost every patient intrusted to his care.

We have referred simple constipation to debility of fibre, to deficient or altered secretions, to indigestible or improper food, to increased tone, to an oppressed state of the cerebral functions, and to an increase of one or other of the secretions from the skin, kidneys, and other organs not so immediately connected with the intestinal canal.

1. The indications of treatment in constipation arising from the first of these causes, where there is simple debility of fibre or loss of tone in the muscular coat of the bowels, are, manifestly, great care in the regulation of the diet, and such a combination of mild aperients with tonics as shall effect the object to be attained without inducing local irritation or over-excitement of any portion of the affected organs. A weak muscular organ may be completely paralyzed by over-exertion, at the same time that moderate exercise with appro-

priate support may restore its tone and enable it to fulfil its functions with efficiency and regularity. Nothing can be more injurious, therefore, in the convalescence from acute diseases, during which, as has been before shown, a degree of this weakened condition is always to be found, than the practice of giving powerful doses of cathartic medicine, because the debilitated intestines do not evacuate their contents with the same regularity and precision as when their powers are in the efficient state of perfect health. A protracted convalescence is the least evil likely to result from such a procedure, and we feel convinced that a recurrence of the original disease is not unfrequently produced by these measures. This is especially the case where the intestinal canal has been the seat of inflammation. In such cases it is of the first importance to guard against any thing capable of exciting local irritation of the debilitated organs, whether in the shape of food or medicine. The food should be altogether of liquid consistence until the bowels are disposed to act without the assistance of medicine, and to procure the necessary evacuations the mildest aperients only should be had recourse to. Castor oil, or a few grains of rhubarb and magnesia with aromatic powder, or the hydrargyrum cum cretâ with rhubarb, will be found in such cases safe and in general effective aperients; or a drachm of the sulphate of magnesia in infusion of rhubarb or chamomile with some tincture of bitter orange-peel may occasionally be taken with advantage. Should these measures fail, it is better to have recourse to enemata than to employ more drastic purgatives.

[Some cathartics are better adapted than others for developing the dormant impressibility of the whole intestinal canal. Such are the saline cathartics. The writer has found great advantage from the following combination:—℞. Magnes. sulphat. ℥j.; Potass. bitart. ℥ij.; Aquæ bullientis Oij. M. The dose of this factitious mineral water is a wine-glassful, which must be taken every morning. By persevering in the use of this for some weeks, the tendency to constipation has been removed in some very obstinate cases. (*Practice of Medicine*, 2d edit. p. 153: Philad. 1844.)]

When, however, this state of debility has been of long continuance and unconnected with any preceding acute disease, as frequently occurs in persons of advanced life, it will be necessary to have recourse to more powerful measures. It is in such cases that the sulphate of quinine in combination with some of the resinous cathartics is often productive of the best effects. Four or five grains of aloes or cathartic extract with one grain of sulphate of quinine and a small quantity of some aromatic essential oil, given at intervals of eight hours, will be found to regulate the discharges from the bowels, and not unfrequently, after having been persevered in for a few days, the dose of the aperient part of the combination will require to be gradually reduced. It should be borne in mind, that from the accumulation which occasionally takes place in such instances, the fæces are apt to lodge in various parts of the intestinal tube. When this has taken place in the rectum, they may require to be broken down and removed by manual means, and where the accumulation occurs in the colon or cæcum, which may usually be ascertained by careful examination of the abdomen, copious enemata should be thrown up, and the contractions of the bowel promoted by occasional frictions over the surface of the abdomen with stimulating liniments, and by the wearing of a flannel roller passed round the body so as to afford moderate compression and support.

[In the torpor of the intestines in which there is a disposition to form scybala, and to retain them in the cavity of the large intestine, Dr. Marshall Hall (*The Principles of the Theory and Practice of Medicine*, p. 398: Lond. 1837,) considers the principal remedy to be, a daily aloetic pill and a warm-water enema; and the plan will certainly succeed generally.]

2. When a deficient or vitiated state of the biliary, mucous, and other secretions poured into the intestines proves a cause of constipation, it will be necessary in the first instance to have recourse to measures fitted to correct the deranged function. We know of no medicine which exerts so powerful an effect in promoting and restoring the biliary secretions as mercury, and accordingly in some or other of its forms this agent is employed whenever the bile is supposed to be deficient in quantity or impaired in quality. There can be no doubt that where there is a torpid state of the liver, and much general oppression of the system with constipation, a full dose either of blue pill or of calomel combined with the compound extract of colocynth, at bed-time, and followed up in the morning by a solution of salts in infusion of senna, will often materially relieve the symptoms, and indeed may generally be had recourse to in the first instance with marked advantage; but unless there is evidence of inflammation existing in the liver, or some change in the structure in that or some other organ—in short, where the disease is simply functional, we do not feel disposed te recommend the plan of mercurialization to the extent to which it has been carried in such cases. The particular attack is certainly in many instances quickly removed under this treatment, but we doubt much whether there is not a greater disposition to a recurrence of the symptoms than where the case has been treated by other measures, less powerful indeed in the first instance, but perhaps on that very account more permanent in their effects. Where the deviation from health of the biliary secretion is but slight, and its effects are chiefly discernible in the constipation induced, we have seen the bowels brought into a regular state, and the evacuations restored to their natural appearance, simply by small doses of colocynth with Castile soap taken at regular intervals of eight hours, and that even in cases where this condition has been of long standing, and to remedy which the habit of taking large doses of strong cathartics had been acquired. The effect of this plan of treatment, when steadily pursued for some time, has been such as to require the gradual diminution of the quantity of the aperient, and at length its entire discontinuance.

Constipation, with pale colour of the evacuations, muddiness of the conjunctiva, and sallowness of countenance, is often found to occur in individuals of sedentary occupations and torpid habit, in conjunction with a feeble circulation and highly nervous temperament. In such cases, large, or even moderate doses of mercurials are productive of very serious injury, either inducing great constitutional depression or considerable irritation in some part of the intestinal tube. Small doses, however, occasionally prove beneficial, as for instance, a single grain of blue pill with an equal quantity of extract of henbane and camphor, followed by a few grains of carbonate of ammonia in infusion of dandelion with a drachm of some bitter tincture, taken twice or three times daily, the bowels having been previously evacuated by a combination of some of the resinous cathartics. Under this treatment we have seen all the symptoms rapidly give way, the bowels becoming regular, the colour of the evacuations healthy, the conjunctiva and skin clearing in the very same individual in whom larger doses of mercury had induced local irritation of the intestinal mucous membrane to a very serious extent.

[Recently, ox gall has been strongly advised by Dr. Charles Day, of Manchester, England, as a direct solvent of accumulated hardened fæces, the consequence of defective quality or quantity of bile in the alimentary canal. The inspissated bile is given in pills in the dose of three or four grains, three or four times a day. Dr. Mettauer, of Virginia, (*American Journal of the Medical Sciences*, July 1843,) employs the inspissated bile of swine. It is very questionable, however, whether the bile of animals can be productive of benefit in such cases. It is, indeed, doubtful, whether the bile have any agency in stimulating the intestines to the propulsion of their contents; and hence any indication founded upon an affirmative view must be regarded as questionable. Sufficient observation has not been had to decide the matter.]

Of those more obscure cases, in which the secretions from the glands, follicles, and surface of the mucous membrane appear to be deranged, we have so little definite information, that in the present state of our knowledge it is scarcely possible to say what measures are most likely to be beneficial: but where the evacuations have been scanty and covered with slimy mucus, or have consisted almost entirely of a gelatinous matter, much benefit will be derived from a combination of blue pill with ipecacuan in moderate doses, given at proper intervals, until the stools become more healthy, and followed by the tincture of benzoin in doses of from ten to fifteen drops three times daily. Where there is reason to suppose that the secretions from the mucous membrane are very viscid and adherent to its surface, the croton oil will be found a valuable remedy in obviating the attendant costiveness.

3. In the treatment of cases where a slight degree of constipation has been induced by taking improper food or that which is indigestible in its nature, the first object is fully to evacuate the bowels of their contents, which may be done by almost any of the usual cathartics,—for instance, five grains of calomel with eight or ten of compound extract of colocynth, followed by the common black draught, after an interval of six hours, or on the following morning, according to circumstances. The subsequent measures will, of course, be chiefly dietetic, such as the prohibition of that species of food which has been found injurious, and the recommendation of that which is more soluble in the secretions of the stomach, and more readily assimilated in the subsequent parts of the processes of digestion and nutrition. Should more permanent disturbance have been produced, and the secretions have become disordered so that the constipated state continues, it will be necessary to have recourse to the measures recommended under the preceding division.

It is, however, in constipation arising from this cause that we find those severe cases of obstruction of the bowels which not unfrequently demand all the resources and all the perseverance of the physician to conduct to a successful termination. Some hours after a hearty meal, in which there has been either excess in the quantity of food taken, or inattention to its quality, the bowels will become constipated, at the same time that there is a sense of distension of the abdomen generally, with fulness and uneasiness on pressure in some part of the larger intestines. Under these circumstances a dose of aperient medicine is taken, which may either give rise to considerable pain without affording any relief, or may be rejected by vomiting. More powerful cathartics are now given, and the distended bowel, through the injudicious and hasty use of such measures, is irritated into inflammation, and much and often irremediable mischief done before medical advice is had recourse to. The first efforts of the physician, under such circumstances, should be directed to subdue the inflammatory action by general and local bleeding, and having accomplished this object, without which all that can be done for the relief of the patient must be in vain, he may direct his attention towards the removal of the obstruction and procuring the evacuation of the contents of the bowels. We will not say that in no instance where constipation arises from undigested food, is the removal of it to be attempted by aperient medicines, for if the patient be seen before any threatening of inflammation has taken place, it may be right to give a full dose of calomel combined with cathartic extract and extract of henbane; but if this fail of its effect, and local uneasiness be induced, or if the medical practitioner be called to see his patient under the circumstances before-mentioned, it will be desirable to avoid giving purgatives by the mouth, and to endeavour to remove the obstruction by the use of copious enemata, assisted by frictions of the abdomen, &c. The following case, though one of frequent occurrence, will perhaps point out the mode of treatment to be pursued in such cases better than more general observations.

A man of middle age had experienced a severe attack of colic with constipation, for which he took some strong cathartic medicines without relief to his symptoms, but with the effect of inducing considerable tenderness in the left iliac region, where there was also some fulness. Leeches were applied to the seat of the pain with immediate relief, and after the pain had subsided the bowels were readily evacuated by enemata, followed by a saline aperient. In the course of a few days, in consequence of some irregularity in diet, his bowels became again constipated. Three grains of calomel, combined with eight of compound extract of colocynth and three of the extract of henbane, were ordered. No evacuation followed, but the pain returned in the left iliac region, and was now accompanied by general tenderness and tympanitic distension of the abdomen, and some nausea and disposition to vomiting. He was bled from the arm, and leeches were twice applied to the abdomen within a few hours, and afterwards warm anodyne fomentations. Under these measures the inflammatory symptoms gave way, the tenderness and tension of the abdomen subsided, but the descending colon, just above the sigmoid flexure, could be felt distended, and the part was uneasy when pressed. Copious enemata of thin gruel and of salt and water were repeatedly thrown up, and as there was some difficulty experienced in passing them, the rectum was examined, and a bougie introduced as far as it could be passed without giving pain, but no unnatural state of the lower bowel was detected. The enemata were returned at first without change, but subsequently they became more and more coloured. The obstruction now appeared to descend; gentle friction was made over the part with castor oil, and the enemata were persevered in, till at length a considerable quantity of fæcal matter, in a dissolved and fluid state, came away. The local uneasiness then completely subsided, and the bowels were subsequently regulated by a teaspoonful of sulphate of magnesia with fifteen drops of tincture of henbane, taken in peppermint water every morning. The duration of the constipation in this case was eight days. An enema of cold water, as recommended by some of the French practitioners, was thrown up once, but without producing any apparent effect; and as the measures employed were found to be gradually effecting their object, it was not thought necessary to have recourse to others, the success of which might have been doubtful. Among those means which have been recommended in such cases, the dashing of cold water over the lower extremities has succeeded in removing the obstruction where other measures have failed; and the warm bath is frequently a very effectual remedy. The principles of treatment, however, to be kept in view are manifestly to subdue and keep down inflammatory action, and steadily to persevere in soliciting rather than in forcing the evacuation of the contents of the bowels.

4. Where a constipated state of the bowels is produced by increased tone, it is scarcely such as to require remedial measures for its removal, and is best counteracted by taking a greater proportion of ripe fruit or well-boiled vegetables, or other food of a slightly laxative nature.

5. The treatment to be followed in cases where the constipation is complicated with and the effect of an oppressed state of the functions of the nervous centre, may be deduced from the observations which we have already had occasion to make in the first part of this paper, while considering this cause of the functional disturbance. The attention must, in all such cases, be directed to relieving the cerebral or spinal oppression by the application of leeches to the temples or by drawing blood by cupping from the back of the neck, at the same time that efficient doses of aperient medicines are given to act upon the bowels. The use of calomel is especially beneficial in such cases, probably on account of the tendency of this medicine to equalize the circulation.

Children seem to be very liable to this form of constipation, and in consequence of the predisposition which the age of infancy gives to hydrocephalus, it becomes a subject requiring close and anxious attention. Whenever, therefore, there is a confined state of the bowels existing in a child, accompanied with heat of the scalp and any dulness or heaviness of expression, it is of the first importance carefully to watch the progress of the case. From two to ten leeches, according to the age of the child and severity of the symptoms, should be immediately applied, and from one to three grains of calomel, with four or five of jalap, given and repeated according to circumstances. When the head has been relieved by the local depletion, the subsequent operation of the cathartic will be materially assisted by the employment of the warm bath.

The obstinate constipation which occurs in females of an hysterical constitution, and where spinal irritation has been ascertained to exist, requires a mode of treatment materially differing in many respects from that which is adapted to other forms of this functional derangement. In such cases it will be necessary to apply leeches and blisters over the painful vertebræ, with other measures recommended under the head of spinal irritation. The most efficient aperients will be found to be combinations of aloes with myrrh, galbanum, and other antispasmodics, together with terebinthinate enemata, and where the symptoms of hysteria are more decidedly marked, clysters containing assafœtida will occasionally be found successful when other remedies have failed of their effect. In a very interesting case reported by Dr. O'Beirne, (New Views of the Process of Defæcation, &c.,) in which there was most obstinate constipation, (no fæces, it is affirmed, having been passed for six months,) attended with great constitutional disturbance, and subsequently ascertained to be connected with spinal irritation, immediate relief to the constipation was experienced from the employment of the tube and syringe, as recommended by the author in cases of constipation. A gum-elastic tube was introduced into the sigmoid flexure of the colon, and an injection thrown up through the tube with the effect of removing, in less than two minutes after the withdrawing of the tube, an enormous mass of solid fæcal matter. The patient was not, however, restored to health till proper measures had been adopted for the cure of the spinal disease.

6. In the case of excessive secretions from other organs of the body inducing constipation of the bowels, the obvious indication is to moderate the activity of the disordered functions, and to restore the general equilibrium; but as this is a subject which scarcely falls within the compass of our present object, we shall content ourselves with referring to such of the essays in the preceding pages of the Cyclopædia as relate especially to these diseased states, and in which the measures to be pursued in such cases will be found detailed.

In the second class of cases, or those in which the constipated state is connected with and dependent upon obstruction taking place in some part of the intestinal tube, the treatment will often be found to require the greatest circumspection.

1. The frequent connection of this condition with hernia is one which should ever be borne in mind, and in no instance is it of more importance to ascertain the cause giving rise to the attack than in the cases where constriction of the bowel arises from this source. A careful examination should therefore always be made, to ascertain this point, and should a portion of intestine be found displaced and incapable of being reduced, no time should be lost in requesting the assistance of the surgeon. The measures to be subsequently pursued fall under the department of surgery, and will be found detailed in the valuable works of Sir Astley Cooper and others upon this subject, with which that branch of the science of medicine is enriched.

2. For the treatment of constipation, when it arises from inflamed states of the serous and other textures forming the coats of the bowels, we must refer to the articles ENTERITIS and PERITONITIS; and where it occurs in connection with what has been considered spasmodic constriction of the muscular coat, to the article COLIC. We have already expressed our opinion respecting the infrequency of the existence of spasm as a cause of constipation and colic, and shall therefore only further observe, that the measures which are commonly found successful in such instances, viz. local blood-letting, frictions, anodyne fomentations, and the internal exhibition of opiates, are precisely those which are calculated to moderate the action of the propelling fibres of the muscular structure, which by the twisting pain experienced in these affections would appear to be in a state of partially increased activity above the distended portion, rather than of fixed spasmodic constriction below it.

3. The treatment of that form of constipation which arises from an affection of the cæcum, must be regulated by the kind and degree of disease existing in that part. If there be reason to suspect that the cæcum has become distended with fæcal matter, but without any chronic inflammatory thickening of the intestinal tunics having taken place, then a plan of stimulating purgatives may answer well the object we have in view. Two pills, for example, may be given every other night, containing five grains of blue pill and five grains of compound extract of colocynth, and a mixture may be directed twice a day, of carbonate of soda, compound decoction of aloes, and infusion of quassia; in addition to which an enema of salt and water may be injected by means of the syringe every morning, taking care that a sufficient quantity of fluid shall be thrown up to pass into the cæcum.

If, however, there be reason to suppose that the inactive state of the cæcum arises from, or is connected with, a chronic inflammatory action in the mucous, muscular, or peritoneal coat of this intestine, then it will become necessary to conjoin local bloodletting and blistering with the purgative plan, and the kind of purgative must be changed. Calomel, in conjunction with cathartic extract, may then be given every night, and a saline aperient, consisting of sulphate of magnesia, carbonate of magnesia, and peppermint water, may be administered every four hours. If the symptoms do not give way to these measures, it will be desirable to employ the mercurial inunction over the abdominal surface, or, what appears to answer still better, to use an ointment consisting of one ounce of the mercurial ointment with half a drachm of hydriodate of potash. An ointment thus formed is singularly efficacious in promoting the absorption of thickening produced by chronic inflammation. In some obstinate cases of inactivity of the cæcum, we have seen the best possible effects follow the use of the compound gamboge pill, ten grains of which may be given every night at bed-time, and may be continued until the tumour which is felt in the region of the cæcum is lessened by the free evacuation of the bowels. It is surprising to observe the immense discharge of offensive fæcal matter, bearing the appearance of having been long retained in the bowels, that is passed away in some examples of constipation connected with accumulation in the cæcum; and those accustomed to watch the progress of such cases would scarcely be disposed to believe that so much could be retained in the intestinal canal. Where once the disposition has taken place in the cæcum to allow its contents to accumulate, and thus to form a large pouch full of fæces, it requires much caution in diet and regimen to prevent a recurrence of the same affection, and indeed we believe in many instances, despite of all the care that can be taken, this occurrence cannot be averted. A due attention to exercise of the body, and a proper regulation of the diet, taking the precaution to eat such things as are light of digestion and of rather an aperient quality, will often for a length of time secure a due degree of peristaltic action in this part of the intestinal canal, and preserve it from undue distension. In addition to this, the application of a stimulant mercurial plaster over the part, and the frequent use of an enema, especial care being taken that a sufficient quantity of fluid is injected into the colon, are very important.

The treatment of constipation which depends upon a diseased condition of the colon, requires great discretion in the use of remedies; for if in this case irritating cathartics are injudiciously used, much mischief may be produced, and there can be no doubt that the continued use of violent cathartics may go far to occasion permanent stricture of the colon.

When it happens that from any cause the colon has not for some time passed on its contents, but has allowed the fæces to accumulate there, spasm of the muscular bands of this intestine is sometimes produced. This is not a state in which the use of drastic purgatives can be of any service; on the contrary, they may increase the spasmodic action and add to the griping pains, without relieving the bowels of their load. The exhibition of a dose of calomel and opium, with half an ounce of castor oil, repeated every four hours, will in such cases often act freely upon the bowels, and relieve the pain.

Where the longitudinal bands of this part of the intestines are in a painful state, it is more especially necessary to avoid inducing any appearance of dysenteric motions by the use of irritating cathartics, such as senna, &c., but those of a milder and more soothing nature may be employed. Sometimes, in an inactive state of the colon, stools are passed containing much mucus and very little fæcal matter, whilst at the same time a large quantity of fæces may be retained in the cells of the colon. The daily use of unirritating injections is in this case often attended with much advantage, and the decoction of linseed is particularly suitable for the purpose. It is not, however, well to trust entirely to enemata. The use of alterative and gently aperient medicines will greatly assist in bringing about a more healthy action of the colon: one grain of blue pill and one grain of extract of henbane taken three times a day, together with a mixture consisting of fifteen grains of sulphate of magnesia, one drachm of mucilage, and an ounce and a-half of water, will very frequently greatly assist in discharging the accumulation from the colon, and in bringing about a healthy secretion from its mucous membrane.

If constipation be depending upon an inactive state of the colon, unconnected with any disease of its mucous membrane, the compound extract of colocynth in combination with calomel may be given at bed-time twice a week, and a senna draught the following morning. This plan, however, should not be long continued, but after a time recourse should rather be had to daily enemata of salt and water, or of gruel. It is in this form of constipation, when of an obstinate nature, that we think much benefit arises from the use of croton oil, one drop of which may be given in combination with soap every four hours; or half a drop of the oil may be administered with cathartic extract and calomel, in the proportion of four grains of the former to one of the latter, every four hours.

Should constipation be dependent upon stricture, either in the ascending portion or in the sigmoid flexure of the colon, it is usually attended with peculiarly severe pain and much flatulence. It is here of particular importance to avoid all violent and irritating medicines; for the most part the preparations of mercury are not of any avail, and if calomel is given, it should be combined with an anodyne. As an aperient, sulphate of magnesia in small doses, dissolved in water, with the addition of a few drops of laudanum, and given every three or four hours, when assisted by injections, will often succeed; or castor oil in small doses frequently repeated, and combined with a few drops of laudanum, will act upon the bowels without exciting much pain.

It is of great importance, when stricture of the colon exists, to be enabled to use some remedy, which, without proving in any way irritating, may keep up the peristaltic action of the bowel. The tincture of benzoin is a medicine of this kind, and we have often known twenty drops of it taken three times a day succeed in keeping the bowels active, in some instances of constipation apparently dependent upon some stricture of the colon. In constipation also of this nature we observe the happiest effects from the occasional use of aperient saline mineral waters. The waters of Leamington or Cheltenham have often succeeded in giving temporary relief to many persons who have looked for it in vain from other remedies.

When the cause of obstruction exists in the sigmoid flexure of the colon, we have the disease more within reach than in its ascending or transverse portions. If, therefore, the ordinary measures which are employed fail in getting rid of the fæcal accumulation, we may sometimes obtain relief by passing a hollow flexible tube into the colon, which if possible should be carried through the strictured part. We are then enabled to inject the fluid immediately through the affected part, and in this manner the colon is sometimes called into action, and a very large quantity of fæces is passed away. It is difficult to say how much fluid may in some of these cases be thrown up, it depends so much on the degree of dilatation that the colon will admit of in particular instances. The quantity we have known to vary from less than a pint to as much as a gallon. This latter quantity we remember to have seen frequently thrown up in an old gentleman, who for years had been the subject of constipation from enormous accumulations in the colon, which appeared not to be the result of stricture in any part of it, but merely from want of action in its muscular fibres. In this case, after constipation of long duration, as much as a gallon of salt and water has been thrown up every morning for a week successively, and scarcely any fæcal matter would for several days pass; but at length the repeated use of the injection would call the muscular fibres into activity, and then an enormous mass of fæcal matter would be parted with, sometimes amounting to so great a quantity as to render it a matter of astonishment how the colon could have been so far distended as to contain so large an accumulation. This was an instance of paraplegia; and it is in cases of this kind that we believe the colon, without any stricture, is most liable to become enormously distended by its fæcal contents.

A modification of this practice has lately been recommended by Dr. O'Beirne of Dublin, in his work on the Process of Defæcation, which he considers to be applicable in most cases of constipation. His plan consists "in the introduction of a large-sized gum elastic tube through the anus into the sigmoid flexure of the colon, and, after giving exit to such flatus and fluid fæces as may happen to escape, adapting to it a proper syringe, and throwing up such purgative fluids as circumstances may make it necessary to select." For more particular details we must refer to the work itself, and to the cases with which it is illustrated.

[The common mode of throwing enemata into the rectum only by the ordinary syringe or by the bag and pipe is often exceedingly ineffective. If we desire to have the full benefit of the injection, the plan, recommended by Dr. O'Beirne, and now in constant use, is indispensable.]

4. When constipation depends upon relaxation of the rectum, we cannot expect to produce any great effect upon the disease by remedies taken into the stomach. It may nevertheless be sometimes desirable to improve the general tone of the alimentary canal, and to stimulate the muscular fibres of the relaxed intestine. With this view the use of a mixture twice or three times a day, composed of carbonate of soda, infusion of senna, and decoction of bark, will often prove beneficial

But in this affection, as Mr. Chevalier very properly observes, "the principal and most certain relief is to be obtained from the proper employment of glysters, the composition of which is to be regulated by circumstances. At first those of a mild aperient nature should be preferred, and thrown up by a syringe; and these should be repeated after regular intervals, so as to reaccustom the rectum to empty itself in an habitual way. Gruel, the decoction of mallows, broth, or milk with some honey, will answer the purpose very well; but more permanent good will be derived by using afterwards the infusion of chamomile, or the old decoction *pro fotu*, which, by gently stimulating the torpid surface of the bowel, may bring on a proper contraction of its coats. Where the very lowest part of the rectum continues so dilated as to allow the upper still to descend, from four to six ounces of a strong decoction of oak-bark, or an infusion of galls, thrown up as gently as possible every night, will be attended with the most beneficial effects. If this be not readily retained, a little starch, or a few drops of tincture of opium, or both, may be added to it; and care should be taken, at the same time, so to regulate the diet and medical treatment, that the upper part of the intestinal tube may be excited to due action, regularly, bût not violently."

5. It is particularly important that judicious management should be adopted to keep the bowels properly open in stricture of the rectum. So much mischief may be done by irritating the bowels by drastic purgatives, that no reflecting practitioner will now venture to use this class of aperients where stricture of the rectum exists. But we may often, by mild and frequently repeated doses of gentle aperients, which have a tendency to keep the fæces in a liquid state, succeed in preventing severe constipation from taking place. The remedies which are most beneficial in this state are combinations of small doses of simple extract of colocynth, extract of henbane, and blue pill, to be repeated every or every second night, castor oil taken in the dose of a teaspoonful every second or third morning, or one drachm of sulphate of magnesia dissolved in six ounces of water, and taken every morning. We have known instances where, by this means, life has been apparently much prolonged in stricture at the lower part of the rectum, as the fæces have been kept continually liquid, and all accumulation above the strictured part has been prevented. On the same principle, great benefit occasionally arises in constipation from stricture of the rectum, by having recourse to the use of mineral waters. During a residence of three weeks or a month at Cheltenham or Leamington, we have known persons thus affected greatly relieved, and the bowels kept in an open state, without any irritation of the strictured part being thereby produced.

We must not, however, trust to these or any other remedies given by the mouth, as, fortunately, the cause of constipation in this case is sufficiently near the anus to allow of remedies being there applied, and sometimes with great effect, to remove it. The stricture may sometimes be dilated by means of bougies, and the mechanical obstruction to the evacuation of the fæces in this way removed; or we have it in our power to throw up glysters through the strictured part, thus rendering the fæces more pultaceous and more readily transmissible through the narrowed part of the intestinal tube.

There may be doubts as to the applicability of bougies in every case of stricture, the irritation produced by them being so great as to counterbalance any advantage that may be expected to be derived from their use. Where the stricture is of a scirrhous or carcinomatous nature, there is but little prospect of any benefit being derived from their employment, and we have oftentimes known, where the introduction of the bougie has been attempted in such cases, that the pain arising from it was so great, that the patient would rather suffer from the disease than the remedy. Indeed, it is obviously most judicious in this form of the malady to abstain from using any means that cause irritation, and all that we can attempt in this unpromising condition is to relieve the bowels of their load with as little disturbance of the affected part as possible. On this account glysters of milk and water, or decoction of linseed, are preferable to those of a more stimulating nature; and where the evacuation produced by their injection is productive of much pain, it will be desirable even to allay the irritation thus occasioned by a small glyster of laudanum and starch.

It is, however, in strictures which are originally of a spasmodic nature, and in which afterwards thickening and induration are occasioned by an effusion between the muscular and villous coats, that bougies are used with greatest advantage. But surgeons seem very properly to be far more cautious than they were formerly in the employment of the bougie, even in these cases. Mr. Salmon is entirely opposed to the daily use of the bougie. He maintains that the advantage derived from dilatation of the passage is counterbalanced by the frequency of the irritation, and informs us that since he has ceased to use the bougie daily, and made it his practice to introduce it only once every three or five days, he has effected the required dilatation more rapidly. The manner of introducing the bougie we will give in the words of Mr. Salmon: "A full-sized bougie, not less than eleven inches in length, thoroughly softened and well oiled, adapted to the shape of the passage through which it is to be passed, is to be introduced with the convexity of its curve towards the sacrum, in which way it is to be passed upwards and backwards about two inches through the third portion of the bowel, provided it gives no pain; for the introduction will commonly produce an uneasy sensation. We continue to propel the bougie in the same direction, about three or three and a half inches higher, or through the second portion of the rectum. The point of the instrument will now bear directly upon the hollow of the sacrum, and the but-end towards the left side of the body. With the view, therefore, of avoiding the sacrum, and of accommodating the instrument to the great curve of the rectum, we change its position by describing the segment of a circle from left to right, with the but-end, turning it upwards, at the same time continuing to propel the instrument. Having described this segment, we shall have carried the bougie full four inches farther, or to what may be considered the extent of the rectum. But it is yet to be introduced into the sigmoid flexure: we therefore slightly depress the but-end of the instrument, at the same time propelling it upwards till the whole is fairly within the sphincter. Upon encountering obstruction, trifling pressure is to be maintained for a minute or two; and if under this careful pressure the pain increase, and the instrument remain stationary, it is to be withdrawn, the next size introduced, and so on from above downwards, till we ascertain the size of the bougie, which passes with trifling pain or difficulty fairly into the sigmoid flexure."

We have here given, we believe, the latest and best authority with respect to the use of the bougie; and, without denying the utility of bougies in some cases of constipation from stricture of the rectum, we must again repeat that the irritation of the bougie is sometimes more intolerable than the stricture itself. We, therefore, prefer in all cases of this nature, where any degree of irritation is produced, trusting to the daily administration of an enema of gruel or of linseed tea, which will generally, unless the contraction is to a very great extent, succeed in emptying the rectum, and in checking the further progress of the disease.

With regard to dividing the stricture by the knife, as a means of relieving constipation, we believe it is now rarely practised; and, indeed, the numberless instances in which fatal peritoneal inflammation has succeeded to that practice are quite sufficient to deter us from further trials of it.

As regards the management of constipation where it is connected with *hæmorrhoids*, it would require a full consideration of the manifold circumstances which should regulate our treatment of the latter affection to enable us to do full justice to this question. Hæmorrhoids and constipation stand so immediately in the relation of cause and effect, that it is often difficult to determine their mutual dependence upon each other. It is the general opinion that the frequent necessity for the use of cathartics, and more especially those of a drastic nature, as aloes, colocynth, scammony, &c., is the chief cause of the appearance of hæmorrhoids in constipation; but there is after all a great source of fallacy in this conclusion; for it must be evident that the same constitutions which require the frequent administration of purgatives are also those most liable to attacks of hæmorrhoids. We must therefore not too decidedly determine that the use of cathartics is the cause of hæmorrhoidal tumours.

There can, however, be no question that when hæmorrhoidal tumours have made their appearance, and more especially when they become inflamed, and the cellular membrane surrounding them thickened, it requires much caution in giving medicines for the relief of constipation. It is always, under such circumstances, of great moment to determine how far the hæmorrhoidal tumours themselves, and the thickening of the cellular membrane at the lower part of the rectum, are producing mechanical obstruction to the expulsion of the fæces; and if so, to direct such local means as are likely to remove them. For example, if much inflammation exist in the tumours and the parts adjacent, it will be desirable to abate it by the application of leeches and the use of anodyne fomentations; and we should, at the same time, relieve the bowels by the exhibition of some aperient which will not prove irritating to the inflamed piles. A pill consisting of two grains of blue pill and two of extract of henbane may be given, and with it a dose of castor-oil, varying from two drachms to half an ounce; which treatment will generally succeed in relieving the immediate obstruction and suffering arising from the piles, and make it more easy subsequently to command the action of the bowels by enemata. As an habitual aperient to keep the bowels in a laxative state, sulphur has long been employed in hæmorrhoidal affections, and is most suitable in combination with supertartrate of potash and given twice a day, so as to prevent the bowels becoming costive. When obstruction has taken place from piles, a more active aperient, as before stated, will be necessary.

But perhaps the most troublesome state of constipation, as connected with piles, is that in which, from their long existence, thickening of the cellular membrane of the lower part of the rectum, forming a sort of ring around the sphincter, takes place. Under this state it often becomes necessary to employ local means to diminish the obstruction thus occasioned. On examination, we sometimes discover that the thickening may be diminished, and the obstruction to the fæces lessened, by the removal of one or more of the tumours, and wherever this is found to be the case, we should not delay adopting this necessary means of relief. Considerable difference of opinion exists as to the best way of removing hæmorrhoidal tumours, some preferring excising them by the scalpel, whilst others make use of the ligature. There are advantages in each mode of procedure. By using the ligature we avoid all risk of hæmorrhage; but the irritation that is occasioned sometimes becomes serious, and the inflammatory action occasionally extends far up the rectum: this more especially occurs, if any portion of the mucous membrane lining the lower part of the bowel should happen to be included in the ligature. When, therefore, the mucous membrane of the rectum extends over the hæmorrhoidal tumour, a ligature, except in an extreme case, should never be applied. But there are other means besides the removal of the hæmorrhoidal tumours whereby the obstruction arising from them in the lower part of the rectum may be diminished. When the extremity of the rectum becomes filled by several tumours of a chronic nature, the compression of them by the introduction of a bougie into the rectum every or every other day will often lessen their size, and thus facilitate the evacuation of the fæces. Astringent applications may also be resorted to for the purpose of removing hæmorrhoidal tumours. Strong solutions of sulphate of zinc in the less severe cases, and the application of the gall-ointment, often produce very beneficial results.

But necessary as it is to attend to the local affection, when constipation is aggravated by thickening of the mucous membrane of the lower part of the rectum and by hæmorrhoidal tumours, still we must bear in mind that much also is to be effected by diet and proper regimen, the object of which should be to keep the bowels in a soluble state. The occasional use of mineral waters, and especially those of Harrogate, deserves much attention, and will greatly assist our endeavours to relieve this kind of constipation. We have also known instances of this nature, in which the daily use of a drachm of Epsom salts dissolved in six ounces of water has greatly relieved the inconvenience arising from the obstruction produced by hæmorrhoidal tumours. It is, however, unnecessary to dwell longer on a part of our subject more especially treated of in the article Hæmorrhoids.

Spasmodic affection of the sphincter ani—is very troublesome in some persons who are subject to obstinate constipation. Where it arises from the presence of an irritable or inflamed pile, or from chronic inflammation of the mucous membrane lining the extremity of the rectum, these affections must be attended to and removed by appropriate treatment. Sometimes the removal of the painful pile becomes necessary; and sometimes the application of leeches to the extremity of the rectum affords relief, when the spasmodic affection depends upon chronic inflammation of that part. We do not, however, always find, when we have removed the pile or the chronic inflammation of the rectum, that the spasmodic affection of the sphincter gives way, in which case the constipation still continues. Great benefit will then be derived from the use of an opium suppository, or from passing a bougie into the rectum every other day, allowing it to remain there from twenty minutes to half an hour each time, under which treatment the spasm will usually give way.

In some individuals of high nervous excitement, spasmodic affection of the sphincter ani exists alone, without any piles or inflammation of the mucous membrane of the rectum. We have found soothing glysters injected daily, and the use of the bougie every other day, generally remove this very troublesome form of constipation. These measures should be combined with a plan of treatment calculated to invigorate the system and to allay nervous irritation.

The treatment of constipation, when it is ascertained to arise from the pressure of tumours, must necessarily in the greater proportion of cases be merely palliative. Where the tumour admits neither of removal nor cure, the keeping the bowels in a soluble state by castor oil or other mild aperients, and the use of enemata, are almost all that can be done towards alleviating this condition. Change of position, when adhesions of the tumour to the neighbouring parts have not been formed, may in some instances be of service; and when the pressure arises from displacement, as in the case before detailed, in which constipation of twelve days' duration attended with much suffering arose from a retroversion of the uterus, the restoration of the displaced part to its natural situation will afford immediate relief. In narrowing of the pelvis from undue prominence of the sacrum, or other cause producing accumulation of fæces in the colon, the measures required are similar to those which have already been recommended for the removal of this accumulation, where it depends upon stricture seated at the upper part of the rectum. The circumstances impending the transit of the fæces in each case are so far the same, that the passage through which they are to be propelled is narrowed or constricted; but in the one instance it is by a cause seated in the coats of the bowel, in the other by one acting from without. In this latter case, however, there is not the same suffering from the use of the necessary means, as the inner surface of the bowel is not in so irritable a condition; and the cause, though perhaps incapable of removal, is at the same time not likely to progress with the same rapidity.

Previous to bringing these observations to a conclusion, we shall endeavour to impress the importance of attention in all the slighter and merely functional forms of constipated bowels, to two or three general directions, which should always be given to those who are liable to suffer from this state. It is of great consequence in all such cases to establish regularity, both with respect to the times of taking food and the general tenor of the daily habits. The tendency to periodical returns of the same condition of the system has been frequently observed, both in the state of health and in that of disease. In disease the regular occurrence of the evening exacerbation in irritative fevers—of the paroxysms in intermittent and neuralgic affections at the same hour of the day—of epileptic attacks at weekly or monthly periods, afford familiar instances; while in health the regularity with which the returns of appetite and disposition to sleep occur are equally striking. It is, therefore, a point of considerable importance in these cases of constipation to make the attempt at an evacuation at a certain regular hour daily; for when once the habit is formed, the call to evacuate the bowels at the same hour will rarely fail.

Regular and sufficient exercise is a most necessary adjunct in these cases, as nothing tends more to predispose to constipation than close attention to sedentary pursuits. Where this is a necessary part of the habitual occupation, too much stress cannot be laid upon setting apart a portion of each day for the exercise of walking. In many of those who suffer from constipation, the powers of the mind are much exercised; and where this is the case, daily ablution of the head with cold water, with the occasional use of the shower-bath, will be found especially beneficial. Indeed, these measures may always be used with advantage where the powers of the system are not in too debilitated a condition to admit of their employment.

To these precepts, which it is in the power of every one to follow, we shall only further add, the importance of avoiding late hours at night, and of rising early in the morning. Indulgence in the habit of lying in bed, is peculiarly pernicious in predisposing to constipation. The perspiration, both sensible and insensible, is increased; and as a necessary consequence, the urinary and other secretions are diminished; in addition to which, the skin is kept in a debilitated condition, and from the intimate sympathy existing between this organ and the intestinal canal, the due performance of the functions of the latter is necessarily interfered with.

Charles Hastings,
Robert J. N. Streeten.

CONSUMPTION. (See Phthisis.)

CONTAGION, (from *contagium*, *contagio*, *contingo*, *con* and *tango*, Lat.) — By this term is meant the propagation of disease from one individual to another; though it is sometimes used, both in speaking and writing, to denote the matter by which the propagation is effected. In certain cases, those of inoculation, we have perfect knowledge that this propagation is produced by the communication of a noxious matter from the individual first affected to him who receives the disease, and from analogy, and from our inability otherwise to explain the effect on the system, we infer that in all cases of contagion there is a communication of such matter. The body secondarily affected has the property of again generating and communicating to others a similar matter, the disease produced in every case being the same in kind as that existing in the body where the matter causing it is engendered. Diseases thus produced, and possessing the power of engendering such a matter, are said to be contagious, and the matter generated is called contagious matter, or contagion.

All examples of disease produced in one human being by the application of matter derived from another do not come within the scope of this definition. For instance, in the case of certain dissection-wounds, or in the examples related by Mr. John Hunter, of disease produced by the transplanting of teeth, there is no reason to think that the individuals from whom the matter was derived, laboured under any disorder similar to that which was engendered, nor is it ascertained in either case that the disease possesses the power of propagating itself. But were it distinctly proved that either disease possesses such a property, then would it be contagious, though arising from a non-contagious source: for we are not justified in denying that a contagious disease may be generated by other morbific causes than contagion.

Contagious diseases may be divided into those whereof the contagious matter acts only by positive contact between the individuals communicating and receiving the disease, or by its transference in a visible form from one person to another by inoculation; and into those which, though communicable by contact, and in some cases by inoculation, are besides capable of transmission from individual to individual through the medium of the atmosphere. Contagion is therefore immediate or mediate—contactual or remote.

To the former division are to be referred syphilis, gonorrhœa, sivvens, framboesia, itch, porrigo, Egyptian ophthalmia, cow-pox, and probably pellagra and the mentagra of the ancients: to the latter, small-pox, chicken-pox, measles, scarlatina, [?] hooping-cough, [?] plague, typhus, hospital gangrene, influenza, [?] puerperal fever, and, according to the opinion of some persons, yellow fever, and cholera of India. It has been shown, too, by Dr. Wells, that erysipelas occasionally manifests a contagious property. There are two other diseases which were formerly considered contagious, lepra Græcorum and lepra Arabum (elephantiasis). The former is unquestionably not contagious, and from the observations made by the late Dr. Adams in the lazar-house at Funchal, there is every reason to think the latter equally devoid of this quality. Of the two diseases communicable from inferior animals to man, hydrophobia and glanders, it is not ascertained that they may be transferred from one human being to another, which certainly would have been the case with respect to the former, had it possessed the property of remote contagion. The opinion entertained by many veterinary surgeons, that the latter is communicated by contact from horses to the human species, has been amply confirmed by the researches of Dr. Elliotson of St. Thomas's Hospital: whether it be further communicable from one human being to another is not ascertained.

Of the nature of the matter of contagion we know nothing; but attempts have been made to ascertain the laws which regulate its diffusion through the atmosphere. The following are some of the results of these attempts which have been given to the public; although there is reason to think that they do not merit implicit confidence. Dr. Haygarth informs us that in 1777 he began to ascertain by clinical observation according to what law the variolous infection, and, in 1780, according to what law the febrile contagion is propagated. He is of opinion that the pernicious effects of the variolous miasms are limited to a very narrow sphere. In the open air and in moderate cases he supposes that the infectious distance does not exceed half a yard; and hence, he says, it is probable that even when the distemper is malignant, the infectious influence extends but a few yards from the source of the poison. He is of opinion that the contagion of fever is confined to a much narrower sphere than that of small-pox. (Letter to Dr. Percival, p. 8.)

By Dr. Clarke we are informed that the most malignant fever does not render the atmosphere infectious further than a few feet from the patient, or from the contagion preserved in clothes, furniture, &c.; and daily observation, he remarks, confirms the opinion that a person must remain a considerable time within the sphere of infection to receive it. (Report to the Committee of the Newcastle Dispensary, 1802.)

The poison of plague has been said to be so fixed, that to be affected by it requires almost contact, unless the patient's breath be inhaled, by means of which the disease is readily communicated. We have already intimated a suspicion that these restrictions on the sphere of contagion have been imposed with more precision than sound induction warrants; but we believe it may be considered a rule that within this sphere the danger is greater, other things equal, in proportion to the proximity to the patient.

Certain circumstances influence the extent of contagious diffusion. Of these the most distinctly ascertained are atmospheric impurities; for it is ever observed, and we believe it may be predicated of every disease possessing the property of remote contagion, that its contagious matter is propagated to greater distances in a dirty, crowded, and ill-ventilated apartment than in one of which the air is pure; whilst diffused through an atmosphere of the latter description, it is speedily deprived of its noxious properties. The same principle applies to articles of dress and furniture; those which are contaminated with animal secretions and effluvia being much more readily impregnated with contagious matter than those which are clean. At the same time it must be remarked, that the neglect of cleanliness implies the multiplication of foci of contagion from the foul clothes and the presence of the discharges from the bodies of patients, and the accumulation of contagious matter from the neglect of ventilation; and hence, though filthy apartments are hot-beds of pestilence, part only of their effect is to be ascribed to foul air.

Besides these auxiliaries of contagion acting in a limited district, there are others more extensively diffused, of which the influence is important. Some of these are well known, whilst others are cognizable only by their effect on the propagation of disease. The effect of those, the nature of which is ascertained, varies in the case of different contagions. The diffusion of plague, for instance, is favoured by a temperature high within a certain degree; whilst it is checked, if not altogether extinguished, by the cold of winter, and likewise by very high temperatures, such as the heat of certain parts of Africa in summer, as mentioned by Alpinus, and that of the Harmattan winds. Typhus, we know, prevails at low degrees of heat, as likewise do measles and scarlatina; and so of different contagions, we find the effect of temperature on them varies in the case of different diseases. A moist and still atmosphere, may, if we mistake not, be declared favourable to the propagation of all contagious disorders; whilst it is sometimes suddenly checked by strong commotions in the air, such as storms and hurricanes.

But besides these appreciable atmospheric states, which in one way or another influence the diffusion and action of the matter of contagion, there are conditions of the air favourable to its diffusion, or otherwise, of the real nature of which we are ignorant beyond their influence over the propagation of disease. It has occurred to every medical man to see diseases, justly considered contagious, unusually prevalent in one season compared with another, though there may have been no discoverable difference in the atmospheric states to explain this variety in their prevalence; and to see them, on the other hand, decline and finally disappear long ere individuals susceptible of the contagion were wanting, without there having been any appreciable change in the state of the air to account for that in the disease. This atmospheric peculiarity, to which the name *epidemic constitution* has been sometimes applied, occasionally appears to possess a limited locality; for we find a contagious disease prevailing in a town or village, whilst places in the neighbourhood escape, though there is a constant intercommunion between the infected and healthy districts; or such a disease may spread extensively in one town, whilst in another, similar as to the habits and character of the population, and not remote in situation, it may exist, but be by no means so prevalent.

A distinction has been proposed between diseases transmissible from one human being to another, and between the terms applied to them, founded on the influence exerted by atmospheric peculiarities over their propagation. It has been suggested that the word contagious should be limited to diseases which are capable of transmission under any circumstances of the atmosphere, pure or impure, such as measles or small-pox; whilst those which are communicable only in impure or vitiated air, as some have conceived typhus and certain other diseases to be, it has been proposed to designate by the term infectious exclusively. It will be understood that a corresponding distinction is intended between the words contagion and infection. In the first place, it may be remarked that the distinction between the diseases to which the terms are proposed to be respectively applied is hypothetical; for atmospheric impurities and peculiarities appear to have an influence on the transmission of all diseases, and it seems very questionable whether any disease, not in its own nature communicable, is rendered so by such impurities and peculiarities. Again, the words have long been used by medical men, when speaking of the transmission of disease, as strictly synonymous, and they have applied them indifferently to small-pox and typhus; and the attempt to restrict them in an unwonted manner has been productive of confusion, such limitations having the same pernicious effect as needless neologism. It may be remarked, however, that infection, though in the ordinary language of the profession strictly synonymous with contagion when employed to denote the transmission of disease, is used in a sense which the latter word does not admit, that of contamination by any thing injurious to the human frame; for which see INFECTION.

Of the diseases enumerated as contagious, small-pox, measles, scarlatina, and hooping-cough affect individuals but once in the course of their lives; at least this *is* a very general rule. The privilege of furnishing immunity from future attacks has been claimed, too, for yellow fever; but it seems very questionable whether the exemption afforded by it be of the general nature of that enjoyed by those who have undergone the exanthematous diseases and hooping-cough. It is indeed doubtful whether the comparative immunity furnished by attacks of that disease be any thing more than part of the general seasoning process by which the constitution becomes hardened against the influence of certain climates and their diseases. Were it unequivocally established, yet would it furnish no material evidence in favour of the supposition of this disease being contagious, unless the furnishing of exemption from second attacks were a property of contagious diseases generally, which is not the case.

A period generally intervenes between the application of contagious matter and the occurrence of the disease which it generates, varying in different diseases, and in different cases of the same disease; for instance, in scarlatina this period is said to range from three to five days, but occasionally extends to twenty-one, (*Dr. Maton*, Med. Trans. vol. v. art. xi.;) in measles from ten to fourteen; in natural small-pox from six to twenty-one; and in the inoculated disease from four to eighteen; whilst Dr. Whytt's very unhappy experiment showed the interval for inoculated plague to be only three days. The contagion of typhus is sometimes instantly felt in the system, as in an example which the late Dr. Gregory used to relate in his lectures, of an individual who instantly sickened and became affected with fever on kicking some chaff thrown out of a bed on which a patient ill of fever had lain; and in another mentioned by Dr. Tweedie, in his Illustrations of Fever, of a nurse in the Fever Hospital, who sickened whilst examining the evacuations of a patient, and passed through a most severe form of fever. Dr. Marsh's observations upon the origin and latent period of fever (Dublin Hospital Reports, vol. iv.) abound with striking instances of the instantaneous occurrence of the disease on the application of its cause; but the interval from the application of the poison of typhus to the production of its effect, there is reason to think, extends frequently to three weeks or a month, and even sometimes to sixty-eight days, (*Bancroft* on Yellow Fever, p. 515.) The latent period of the poison of hydrophobia is longer than that of any other disease we are acquainted with. This period in the case of some diseases is not one of perfect health. In that of typhus a great degree of nervousness, inappetency, mental dejection, and debility often precede for days or weeks the symptoms which denote the commencement of the febrile movement in the system. It has occurred to the writer to observe cases in which the low but exhausting degree of indisposition attending this period has constituted the greater part of the disease which has destroyed the patient. He has visited persons who, though they had felt themselves indisposed for weeks, had persevered in their accustomed avocations in spite of this feeling, which they thought lightly of, and have then suddenly sickened with the worst symptoms of the last stage of typhus, and expired within forty-eight hours. An author already quoted, Dr. Marsh, deserves the thanks of the profession for calling their attention to the importance of this period and its proper management.

The most certain evidence we can have of a disease being possessed of a contagious property is its being communicable by inoculation. By this is meant the transference of a visible and palpable fluid, through which we must suppose the subtile matter of contagion to be diffused, from one individual to another, or from one to another part of the same individual. It is designedly practised, as is familiarly known, in small-pox and cow-pox, and also, from improper motives, in purulent ophthalmia. The application of the matter of gonorrhœa to the eye of the person affected with it is an example of the second kind of inoculation mentioned. Inoculation of one individual from another is possible in all cases in which a morbific matter, capable of being transferred by art, is engendered, of which examples in addition to those mentioned may be found in both divisions of contagious diseases. Some disorders, too, which do not during the life of the patient generate a matter which may be artificially transferred, have yet appeared to be communicated in this way by dissection-wounds; a description of cases very distinct from those adverted to of such wounds, in which the individual dissected did not die from a disease of the same nature as that produced in the injured individual.

The other proofs are, repeated examples of persons contracting disease from contact with persons labouring under it, or from being near to them, or from being in the same situation with respect to fomites. An inference may be drawn, too, from the exemption of individuals from a disease who sedulously avoid the sick and fomites, compared with the liability of those who neglect such a precaution. By fomites are meant matters, such as goods of any kind, clothing or furniture, which, having been near the sick, are impregnated with the emanations from their bodies. This may happen to the clothes of individuals who visit them; and in this way an attendant or visiter of patients may communicate a disease to others though he escape it himself, being secured from it in certain cases by having previously laboured under it; in others by insusceptibility of that peculiar contagion, as is frequently exemplified in puerperal fever. It is obvious that the poison may by accumulation exist in a very concentrated state in fomites which have been long near the sick or in contact with them, and consequently we find that some of the worst cases of contagious disease are produced by their means.

With respect to diseases communicable only by contact or inoculation, all doubt of their contagious nature has long ceased; and of those enumerated in the second division, some, which cannot be propagated by inoculation, especially of the exanthematous disorders, are admitted by all observers to possess this property. But respecting others the agreement on this point among medical men is by no means uniform; and controversies have hence arisen as enduring and acrimonious as any recorded in the annals of medicine. The attempts to decide this perplexed question in the case of any disputed disease, must be made in another part of the work; but it belongs to this place to point out the tests, (which owe their value to their being proofs of the circumstances already mentioned, the reception of disease by direct intercourse with the sick, and immunity from it by rigid seclusion from them,) by which any individual case should be tried, and by which alone it can be decided.

1. Contagious diseases frequently spread in places previously healthy, shortly after the arrival in them of persons from infected districts. The same remark applies to fomites. It is the more apt to occur in the case of persons, if they be sick on their arrival or become so shortly after.

2. When a case arises in a limited district, the disease spreads gradually through it as from a centre towards a circumference, but more rapidly, *cæteris paribus*, in proportion to the density of the population, and the intercourse of the healthy with the sick.

3. Persons whose official duties bring them into habitual and close communication with the sick, such as the medical officers and other attendants on public institutions which contain many cases of a disease, are affected with it in a greater proportion than other members of the community similarly circumstanced with themselves, the intercourse with the sick excepted. The number infected from among the different classes of such attendants bears a proportion to the closeness and duration of their communication with the sick;

for instance, the nurses, and in military hospitals the orderlies, are more frequently attacked than the medical officers.

4. The contagious quality of a disease may be inferred from frequent instances of the success of measures taken to prevent its propagation, such as the early removal of the sick. The importance of the evidence to be derived from this source cannot be more clearly shown than by the following statement of Dr. Alison: "We should have little difficulty in pointing out above a hundred houses where a single case of fever has occurred, where the patient has speedily been removed and the place cleaned, and where there has been no recurrence. But we should hardly find five houses in all the closes of the old town of Edinburgh, in which a patient in fever has lain during the whole or even during the half of his disease, in which other cases of the disease have not shown themselves."*

5. Those who seclude themselves from all communication with the sick and with those who visit them, and receive no commodities which have been in their possession or near them, escape the disease; whilst persons similarly circumstanced in all respects, the seclusion excepted, are attacked by it. The same rule applies to countries or districts secluded by quarantine or other regulations from neighbouring countries, similar in soil and climate, where disease is prevailing; though it must be acknowledged that the cases are rare in which a precise conclusion can be drawn from this latter case of exemption.

6. An inference favourable to the supposition of a disease being contagious, may be deduced from the circumstance of there being nothing in the soil or climate where it prevails fitted to engender other causes of disease, such as malaria. A similar inference may be drawn, when disease is prevailing in a limited district, from the cleanliness observed there, and the consequent exemption from infection which might be occasioned by the effluvia from decomposing animal and vegetable recrements. The previous state of health, too, of the district or country, particularly as regards the disease which is the subject of investigation and diseases of the same kind, may furnish the medical reasoner with powerful arguments.

It must be remarked that, in all investigations into disputed cases of supposed contagion, as many tests as possible should be brought to bear upon the points; and that these tests should be secured by a specification of all particulars which tend to show that malaria was not an agent in the production of the disease respecting which the controversy exists. A reference to a few examples of the successful application of the tests will be the best means of putting the reader in possession of the nature of the detail required for the security of his argument.

Those of Dr. Alison have already been referred to, and the reader may be assured that he can consult none more valuable.

In Dr. Tweedie's Clinical Illustrations of Fever the following instance is given of the successful application of the third test, the prevalence of disease among persons officially employed about the sick.

"Every physician, with one exception, (the late Dr. Bateman,) who has been connected with the Fever Hospital, has been attacked with fever during his attendance, and three out of eight physicians have died. The resident medical officers, matrons, porters, domestic servants, and nurses, have one and all invariably been the subject of fever; and the laundresses, whose duty it is to wash the patients' clothes, are so invariably and frequently attacked that few women will undertake this duty. The resident medical officer was attacked with fever, and it became necessary to appoint some one to perform his duties. The first person who thus officiated took the precaution of sleeping at home, yet his duties were soon interrupted by an attack of fever which confined him a considerable time. He was succeeded by an individual in robust health, a disbeliever in the doctrine of contagion. He performed his duty only ten days when symptoms of severe fever appeared.

"There is no security in this narrative, striking as it is, against the favourite argument of the non-contagionists; but the following collateral circumstances present an obstacle to the intrusion of malaria, which only bigotry or the spirit of partisanship can enable it to surmount. The Fever Hospital stands in the centre of a large field, where the production of malaria is exceedingly improbable, and on the same lawn, and within a few yards of it, stands the Small-Pox Hospital; but no case of genuine fever has occurred among the medical officers or domestics of that institution for the last eight years." The relation these facts bear to the argument is sufficiently manifest.

In the case of plague, of the contagious nature of which it would be easy to accumulate proofs, the following example, selected from hundreds, of the influence of fomites, special seclusion from the sick, and close intercourse with them, illustrates well the nature of the evidence to be derived from the third and fifth tests. When the plague was prevailing in Valetta, in Malta, in 1813, the strictest precautions were used by the inhabitants of the Augustine Convent situated in the town to exclude the disease. At length, however, a servant, contrary to regulations, went into a part of the town where the disease prevailed, and purchased clothes supposed to be infected. Soon after he returned he confessed what he had done, and was immediately shut up, together with one of the brotherhood who volunteered to attend him. Both of them were taken ill and died, but no other person in the convent suffered. A disbeliever in contagion would attribute the disease of the servant to exposure to the malaria of the district in which he bought the clothes; but the monk's malaria must have existed in the convent:—how strange that it should have smitten only one of the brotherhood, and he the individual who alone had intercourse with the sick servant!

There can be no better exemplification of the first test than the occurrences in the Island of Ascension in 1823. This island, remote from any other land, of volcanic origin, and the surface of which consists of volcanic ashes, excepting in one point called the Green Mountain, elevated 2500 feet above the level of the sea, where there is a thin earthy soil favourable to vegetation, but which is very dry, whilst the volcanic surface is said to be dry, arid, and barren, was uninhabited until 1815, when a few British troops were stationed there on Buonaparte's arrival at St. Helena. During the seven years which elapsed from the 7th of March, 1816, to the 7th of May, 1823, but two fatal cases of fever had occurred in the island. On the 20th of April of the latter year, the ship Bann arrived there from Sierra Leone with yellow fever on board, which had attacked ninety-nine of the crew, and ultimately destroyed thirty-four of them. Forty-five men, ill of fever, were landed on the island from this vessel. Eight days after the arrival of the Bann, one case of fever occurred among the inhabitants; but eighteen days after, or on the 7th of May, fever of the same character as that which prevailed on board the ship, showed itself most decidedly; and from this time until the 16th of June, or within six weeks, fifteen persons died, of twenty-eight who were attacked with the disease, out of a population consisting of only thirty-five marines, with some women and children.*

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* On Epidemic Fever, Edin. Med. and Surg. Journ. vol. xxviii. p. 241, where the reader will find most of the tests enumerated successfully applied, to show the contagious nature of the fever of this country.

This case is valuable so far as a much-litigated point of pathology is concerned, but it owes much of its value to the specification of collateral circumstances; such as the nature of the soil of the island, and its previous comparative exemption from fever, which render it improbable that malaria of a degree of intensity sufficient to produce such a disease, had been generated there. At the same time it must be remarked that some cause of fever was endemial at Ascension, for twenty-three cases had taken place in its small population during the seven years preceding the arrival of the Bann, viz., ten cases of continued fever, eleven of bilious remittent, and two simply returned fever; and of these cases two had been fatal, one of bilious remittent, the other of continued fever. It may be observed, too, that islanders, who rarely receive the visits of strangers, are liable to be attacked with sickness of some kind on their arrival, though the visitors may not be unhealthy; as we understand is occasionally exemplified among the Shetlanders. Hence we cannot conclude *positively* that the disease was imported into Ascension; but it must be acknowledged that this case wears more the air of importation than any which has been given to the public—indeed most other attempts to prove importation have been signal failures—and that a few more cases equally striking would set the question of the contagion of yellow fever at rest for ever.

The subject would be left very imperfect if we did not bestow some attention on the question, how far contagious diseases may be produced by other causes than contagion? By admitting that the matter of contagion is the product of a diseased vital action, we are by no means forbidden the supposition that the diseased vital action required to engender such matter may occasionally owe its origin to other causes.

To commence with the simplest case,—if any member of a family becomes affected with catarrh, arising from catching cold, how constantly do we find it passing successively from individual to individual of the family, till the whole are infected, in the manner of contagious disease, though there be no reason to think that the individual first affected received it from any other source than cold, or cold and moisture.

The itch appears to be engendered by mere filth, but when thus produced is manifestly contagious. Some forms of porrigo, too, arise spontaneously, but yet are disseminated through schools and families from the individuals in whom they have thus arisen.

Certain soldiers of a regiment may have suffered at some previous time from Egyptian ophthalmia; they may have been cured of the disease and remained free from all symptoms of it for months, or even years; and the regiment shall consist partly of such men, and partly of men who have never had ophthalmia. If one or more soldiers who have previously suffered from the disease, have the eyes inflamed from exposure to the sun's rays, cold, or intoxication, and the inflammation is so considerable as to produce secretion from the conjunctiva, and the regiment is at the same time in barracks, so that the soldiers are brought into habitual contact, the disease will spread in the manner of a contagious disease, affecting equally those who had previously suffered and those who had not; though the individuals first affected had not been perhaps for years within the reach of any supposable contagious source. The writer is not stating a mere hypothesis, but a matter which has fallen more than once under his own observation. Is it supposable that any poison had lurked inactive about the eyes of these men for so long a period? or, is it not much more probable that, the eyes being disposed to a certain form of disease, the contagious matter was really the product of the inflammation arising from the common causes mentioned?

If from over-crowding, imperfect ventilation, or neglect of cleanliness, or all conjointly, any single sore in the ward of an hospital becomes affected with the disease called hospital-gangrene, it extends to all the sores of the locality. The affection of these, it is true, may be justly ascribed to the common pernicious influence; but let the causes of this influence, over-crowding, defective ventilation, &c. cease, and cases of healthy sores be admitted, and the existence of the contagious principle diffused through the air, or adhering to fomites, is speedily manifested in the character of the sores; and this will continue till the place is evacuated and subjected to a thorough disinfecting process.

The experience of the whole profession proves that erysipelas generally arises independently of contagion; but the facts adduced by Dr. Wells leave it beyond all question that this disease is occasionally communicated by intercourse with the sick.† Whether it owes this property, which it certainly displays but occasionally, to some peculiarity in the nature of the disease, or to extrinsic circumstances, does not appear to be ascertained.

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* Official Report of the Fever, which appeared on board his Majesty's ship Bann, &c., by *W. Burnet*, M. D.

† Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. ii. p. 213, &c.

It has already been remarked that certain circumstances of crowding, filth, and imperfect ventilation, favour the propagation of contagious diseases; but there is every reason to think that the contagious fever of this country may not only be aided in its diffusion by these circumstances, but may actually be engendered by them. We often see in epidemic seasons, fever, not traceable to any other source, springing up in the abodes of the poor, apparently produced by the concentration of human effluvia, and the decomposition of animal and vegetable recrements, though possessing a contagious character when thus engendered. This mode of generation appears often to take place in seasons of scarcity, when physical privations and the depressing passions render the poor a more easy prey to disease, and by depriving them of the moral energy required to preserve order and cleanliness in their dwellings, fit these for engendering infection; whilst the want of clothing and fuel leads them to block up every chink and aperture by which fresh air might gain admittance. The same origination of a contagious disease from a non-contagious source is observed in the typhus of crowded hospitals, jails, and ships, instances of which are so numerous and familiar to the profession that it would be to waste the reader's time to quote individual examples. It does not seem necessary to examine into the question, whether the miasmata produced by the effluvia of congregated human beings, conjointly with filth and its consequent animal and vegetable decomposition, be identical with those generated by the diseased vital actions existing in fever; for in the present state of our knowledge of the subject we have not the means of deciding it. No inference can fairly be drawn from the identity of the effect, for certain diseased states are produced by a variety of remote causes, this expression being employed in the sense usually annexed to it by medical men.

How far other diseases, which according to the very general opinion of the profession depend exclusively on a specific poison for their diffusion, may in some instances owe their origin to common causes, or such as are independent of contagion, it might appear presumptuous to say. That their diffusion is influenced by atmospheric causes, is beyond all question, and there are phenomena displayed by some of them which tend to excite at least a suspicion that such causes may occasionally engender them. To select an example from the exanthemata:—scarlatina appears suddenly in the latter end of autumn; many are simultaneously attacked—so many at the commencement of the epidemic, that it is wonderful where the foci of contagion exist to contaminate them: in its course it manifests unequivocal signs of contagious power; it disappears sometimes suddenly, at others gradually, but long before subjects susceptible of the disease are wanting: no cases are seen for some months; and in the following autumn the same course is recommenced, and the same phenomena are again displayed. Where lurks the poison whilst thus in abeyance, or does it exist any where? Similar doubts and difficulties might be suggested by circumstances connected with the prevalence of measles and hooping-cough.

From the preceding observations it is manifest that the subject is one of great intricacy, and that an ample field is open to the cultivation of the diligent, ingenious, and candid. It is to be regretted that the researches into this very difficult and important subject should generally have been conducted rather with a view to support some preconceived notion, than in the spirit of honest and zealous inquiry after truth.

Means of preventing the propagation of contagious diseases.—These may be succinctly stated to be, the separation, as far as is consistent with humanity, of the sick from the healthy; cleanliness of the person of the patient, and cleanliness and free ventilation of his apartment; the immediate immersion in hot water and subsequent washing of all clothes, &c. removed from his person, which might become fomites; the avoiding, on the part of the attendants, of needless and long-continued proximity to the sick, inhaling their breath, and standing in the current of air which passes over them; and the supporting of the general health of the attendants by nutritious diet and the rest which nature requires. (For further instructions, see DISINFECTION and VENTILATION.

JOSEPH BROWN.

CONVALESCENCE. This term is applied to denote the period or intermediate state between the cessation of a disease and the full restoration of health. When we speak of convalescence from disease, it is implied that there has been indisposition of a more or less serious character, and of some duration, as it is obvious it would be improper to apply this term to ailments of a trifling description. The transition from disease to convalescence, and from convalescence to health, which is seldom sudden, more especially in chronic disorders, is announced by the disappearance of the more prominent characteristic symptoms.

Convalescence is observed to be not only more slow but less permanent in chronic than in acute diseases. It is also modified, in some respects, by individual circumstances: thus, in infancy and childhood it is shorter than in the middle or advanced periods of life; it is likewise more protracted in persons of a feeble constitution, and in those who have undergone long-continued rigorous antiphlogistic treatment, or who have had profuse hemorrhage. It has been asserted that convalescence is in some instances influenced by climate, and that recovery takes place sooner in temperate than in hot countries.

The changes which indicate the stage of convalescence vary according to the nature of the previous illness. They are much less remarkable in chronic than in acute disease. In chronic affections the restoration of the functions of the part affected is very slow and imperceptible: if there has been much emaciation, the flesh and bodily vigour are slowly regained, even though the local disease have been completely removed. Convalescence from acute disease, on the other hand, is more rapid and perceptible, and is announced by the cessation of the more severe symptoms, general as well as local. The frequency of the pulse abates, the heat of the skin diminishes, the thirst decreases, the various functions are gradually restored to their natural state: the tongue becomes clean, the appetite for food returns, and the patient enjoys intervals of refreshing sleep. Besides general signs of amendment, the change from disease to health is evinced in the improved aspect of the countenance: this has always been regarded as a sure criterion of returning health; indeed it may be laid down as an axiom deduced from experience, that unless improvement in the countenance accompany the amendment in the symptoms, the condition of the patient is unsatisfactory. The state of the intellectual powers also becomes improved on the approach of convalescence—there is greater mental energy—the memory, judgment, and imagination, assume their former activity, though continued mental effort sooner induces fatigue than in health. Convalescents from acute disease, however, show great sensibility to external impressions, particularly to extremes of heat or cold; they evince also a morbid nervous susceptibility, and are therefore more prone than usual to irascibility.

Another circumstance which often materially interferes with convalescence, is the supervention of some other disease during this period. It is by no means unusual to find that the original disease from which the invalid was recovering is from some cause suddenly renewed, for it should be remembered that a predisposition having been given by the previous disease, the symptoms may be reinduced by the application of less powerful exciting causes than those which produced the disease in the first instance. In other instances we find that some accidental inflammatory disease appears, and places the convalescent again in danger. This often happens in cases of continued fever; and in the eruptive fevers some accidental symptoms ocasionally arise which materially interfere with convalescence. Thus, in small-pox, after the eruptive stage has passed over, secondary fever often supervenes, which may be in some cases traced to some local disturbance; and we not unfrequently observe in this disease, as well as in measles, a troublesome form of ophthalmia which is tedious and often dangerous to vision. In measles, the convalescence is very frequently interrupted by some other local inflammation, generally of the lungs, or by the supervention of glandular disease, more particularly in the advanced period of the disorder. In scarlet fever the stage of convalescence is also occasionally protracted by various symptoms, which often prove tedious and difficult to subdue. Anasarcous swelling of the extremities of an acute character, with or without internal effusion; glandular enlargements, inflammation of the ear, inflammation of the large joints, irritation of the mucous membrane of the bowels, are among the more troublesome sequelæ which materially retard convalescence in this disease.

Besides these general circumstances which are observed in convalescence from acute and chronic diseases, there are others which characterize recovery from particular affections. It will be found to be a general rule that recovery takes place more slowly in primary than in symptomatic fevers. This slow recovery from fever, strictly so called, is owing to the more general affection of the solids, as well as to the more tedious nature of the disease, which often, in spite of the most judicious measures, runs on for an indefinite period. In inflammatory disorders, on the other hand, when the local affection is subdued, the febrile symptoms in general gradually abate, so that the patient is not only convalescent in a comparatively short time, but the stage of convalescence is also of proportionably limited duration.

In diseases of the brain the functions of this organ are seldom at once completely restored; hence, in the stage of convalescence, we often observe various imperfections either in the intellectual powers or in some of the senses, and these may continue even after the causes which induced them have been removed. When the cerebral affection has been attended with paralytic symptoms, the muscular movements often remain in some degree impaired for a considerable time after the individual may be said to be convalescent. This imperfect state of the muscular power may exist alone, or it may be associated with some defect of the mental functions, or of some of the senses. From these various morbid conditions of the nervous system the invalid may ultimately completely recover, or more or less imperfection may continue for life.

In convalescence from pulmonary diseases, some symptoms often remain which indicate the previous affection, such as cough, or slight acceleration of the breathing on any sudden or unusual exertion. When these symptoms continue, it is evident that the lungs have not regained their healthy condition; that although the progress of the malady has been arrested, it is not wholly subdued; and consequently that it is very liable to be again induced on the supervention of even a slight exciting cause. The same continuance of slight symptoms is often remarked in diseases of the abdominal viscera. In dyspepsia the digestive organs very slowly recover their tone, the convalescence being often protracted by errors in diet; and after the more prominent symptoms have ceased, the stomach remains for a long time exceedingly sensitive, and never fails to give ample evidence of displeasure, when oppressed with food of an improper quality, or with greater quantity than it can readily digest. In inflammation of the mucous membrane of the intestines too, there is often for a long time a troublesome state of the bowels, besides great tendency to renewal of the inflammatory action which may have just ceased, on the application of a very trivial occasional cause; hence the necessity of attention to minute dietetic precepts in this class of diseases.

After these general observations, we shall offer a few remarks on the management of convalescence. It is almost unnecessary to say that this must vary according to the nature of the previous disease, its intensity, and the special circumstances which each individual case presents.

In external diseases the principles of treatment are not only more obvious, but the application and the effects of remedies more nicely regulated, than in internal disorders, and for this obvious reason, that the progress of the disease can be ascertained with almost unerring certainty. *The state of an internal organ can only be known by symptoms,* which it must be admitted give too often uncertain and imperfect indications of its actual condition. There is, however, one among many important advantages of the knowledge of the nature and treatment of surgical diseases to the medical practitioner, that it enables him to form a pretty exact estimate of the value of curative measures, and of the circumstances which advance or retard recovery.

In cases of ophthalmia, it is well known that it is imperative to abstain from all use of the eye, not only during the treatment, but for some time after the inflammation has been subdued. Any deviation from this obvious principle is immediately followed by such effects as are generally sufficient to bring conviction of its importance. The same necessity for caution in cases of inflamed joints comes almost daily under notice. If, therefore, such precautionary measures are necessary in external diseases, in which the various changes are evident to the senses, they are equally requisite in those of internal parts, more especially of the inflammatory kind, in which the changes which the organs undergo are almost precisely the same, while there is the same tendency to relapse, or renewal of the diseased condition, after any irregularity in the management or conduct of the convalescence.

It is quite evident that the first indication in the management of convalescence is to avoid those causes which primarily induced the disease. Another obvious principle is, that the measures to be pursued should always have reference to the nature of the previous disease, and the organ or parts which have been affected. This principle will at once suggest the propriety of abstaining from those circumstances which require such exercise of any organ which has lately been diseased, as might endanger a renewal of the morbid action. Thus, for instance, in recovery from disease of the brain, whatever entails on the patient undue mental effort, should be deferred to a more distant period. In affections of the organs of respiration or of circulation, whatever tends to excite the one or the other must be avoided. It will also be necessary to regulate not only the various functions, but the diet, exercise, and likewise the temperature of the apartment. In convalescence from diseases of the alimentary canal, the practitioner will have to attend to the state of the bowels, but more particularly to the proper regulation of the patient's food. These examples might be extended; but enough has been advanced to illustrate the principles we have endeavoured to inculcate.

Another important circumstance in the management of convalescence is the proper administration of remedies. This must be regulated by particular indications. In some instances, it may be necessary to continue for a time the employment of the remedies which were administered during the disease; for instance, after recovery from dropsical diseases, it may be useful to continue the purgatives or diuretics till the convalescence be nearly established. In other cases the remedial part of the treatment may be entirely suspended, giving occasionally such medicines only as particular circumstances may require.

The most important department of the management of convalescence is the proper regulation of diet. It is almost inconceivable how many errors are constantly committed in this respect, chiefly from want of conviction, on the part of the patient, of its important influence on his recovery, and occasionally from misconception, on the part of the medical attendant, of the principles on which the diet should be conducted. It is a common error to suppose that the debility, which is the almost invariable consequence of acute disease, and which is more perceptible when the invalid first attempts to make exertion, is to be removed by nourishing food and stimulating drinks: it is no unusual circumstance to meet with such erroneous impressions even in cases of muscular relaxation from cerebral disease. When indiscretion is committed under such circumstances, the previous disease, which had just been subdued, is very generally rekindled, and all the primary symptoms are thus reproduced.

Such errors are more liable to be committed in cases of tedious convalescence, where there is a state of undefined indisposition, attended with impaired vigour, so that the invalid does not gain strength, or perhaps loses it progressively. If the state of the organ that was primarily diseased be examined, the cause of the slow recovery will, in the majority of instances, be detected. The disease has possibly not been wholly subdued, or it may from some cause have been renewed. Under such circumstances the folly and hazard of adopting a stimulating plan of diet and tonic remedies is apparent; the only rational indication is to arrest the disease if it be not entirely subdued, or have been reinduced.

The necessity of proper regulation of the diet is greater in convalescence from acute than from chronic diseases; it becomes the more necessary when the previous disease has been severe and protracted, or, though not protracted, when rigorous antiphlogistic measures, and especially large evacuations of blood, have been employed. The tendency, however, of chronic visceral disease to assume, perhaps suddenly, a more active form, should always be kept in view, as well as the fact that nothing is more likely to induce such excitement than errors of diet. It would lead to tedious repetition were we to point out those forms of chronic disease to which this remark is applicable: in such an article as the present, general principles only can be given, which the practitioner may apply to individual cases.

The return from the bland unirritating food which has been allowed in the active stage of acute disease, to food of a more nourishing quality, should be gradual: the first step should be to substitute another article of the same class of farinaceous food, increasing by degrees the quantity, which should be divided into portions to be taken at short intervals. Milk, particularly asses' milk, is a very suitable article of diet for delicate convalescents, and especially children. Another progression may be made by substituting a weak infusion of animal food with a moderate quantity of farinaceous admixture, either of arrow-root, prepared barley, rice, or stale bread. If the condition of the patient admit of it, the liquid nourishment may be abridged, and a very small allowance of solid animal food allowed. Great care should be taken in the selection of, and mode of dressing, the animal food. In general, mutton is most easily digested, and, if it agree, may be preferred exclusively for the first eight or ten days, or exchanged occasionally for chicken. The propriety of first allowing white fish as being a more digestible kind of food for convalescents is questionable. It affords certainly a less quantity of nourishment than animal food, (though this advantage may be gained by diminishing the allowance of the latter,) but it is certainly more difficult to digest, and therefore less suited to the convalescent, besides that it affords opportunity for indulging in condiments and additions of an improper kind. In the advanced stage of convalescence from acute disease, if there be nothing to forbid it, one or two glasses of sherry, mixed with water, may be allowed. When the convalescence is completed and the health restored, a more liberal scale of diet may be gradually adopted, though for a very long time great care should be exercised, so as to avoid any articles which are likely to disagree. It should also be impressed on the mind, that the quantity as well as quality of the food is to be regulated—indeed convalescents often suffer more from too much food, even of a proper kind, than from food of an improper quality.

The due regulation of exercise forms another important part of the management in convalescence. This should not be suddenly resumed—nor at any time carried to such an extent as to induce fatigue; and should be suitably adapted, not only to the powers of the invalid, but to his previous habits and condition of life. We have already shortly adverted to the necessary precautions in exercising the functions of the organs which have been previously diseased. It must be obvious that while all undue exertion of an organ is prohibited, the bodily exercise should be so regulated as not to produce excitement, which might not only be injurious, but endanger the safety of the organ previously diseased,

The necessity of suitable clothing in convalescence is so obvious to the invalid, that it seldom requires to be inculcated by the medical attendant. In temperate places, and more especially in those situations where the temperature is variable, it is necessary to protect the surface for a time by warm clothing, and particularly by flannel under-garments. Some delicate persons suffer so much irritation from the use of flannel, that it becomes necessary to interpose a linen under-dress, or to substitute calico. It should be explained to invalids that the use of woollen garments is not so much for the purpose of affording additional heat, as to protect the surface from sudden atmospheric changes, which, by chilling the skin or exciting the circulation, might reproduce the primary disease.

The atmosphere of the chamber to which the invalid is for a time confined should be frequently renewed; and while attention is paid to ventilation, the temperature should be duly regulated. In the winter and spring months it should be kept as nearly at from 55° to 60° Fah., as possible, while the invalid continues weak. When he has regained his strength it may be gradually reduced, so as to enable him to bear the ordinary temperature of the season, first in an airy chamber, and afterwards in the open air. When circumstances permit, nothing in general tends so much to promote and establish recovery as what is commonly termed *change of air.* In most instances, the improvement in the looks and feelings of the invalid, very soon after he has removed from a confined to a more salubrious district, is remarkably striking.

For further illustration of this subject, however, we refer to the articles CHANGE OF AIR, and CLIMATE.

A. TWEEDIE.

CONVULSIONS (*convulsio*, from *convello*, to pull together.) By the term *convulsion* is meant a diseased action of the muscular tissues characterized by violent involuntary contractions, with alternate relaxations. This diseased action is common to the muscles both of voluntary and involuntary motion, but occurs much more frequently in the former. The term *spasm* has been applied by some to the inordinate action of the involuntary muscles; the term convulsion being more particularly reserved to designate the irregular contraction of the voluntary muscles. By Cullen and some other writers the term spasm has also been applied to the fixed contraction of parts. When the contractions have been of some duration, and are not quickly succeeded by alternate relaxations, they have been called *tonic convulsion*, as is exemplified in tetanus; whilst involuntary alternate motions of contraction and relaxation have been termed *clonic convulsions*, of which hysteria affords an example. The term convulsion has sometimes been exclusively appropriated to clonic convulsion; but as the principal difference between *clonic* and *tonic* convulsions consists in degree, and they both originate in the same causes, it is more convenient for practical purposes to include them under the same head. Very slight and quick alternate motions of contraction and relaxation constitute what is called *tremor*.

Convulsions manifest themselves in various degrees and under various forms. They occur as a symptom in the course of many diseases, and they sometimes assume such regular and well-defined characters as to constitute distinct and separate diseases; as, for instance, in the case of tetanus and hysteria. Convulsive affections have been classed by most nosologists among the *neuroses*, or nervous diseases. Sauvages, Vogel, and Cullen include them as a genus in the order *spasm*. Cullen defines this order "an irregular clonic contraction of the muscles, bordering on but short of lethargy." The presence or absence of lethargy depends, it will be seen, on the seat of the exciting cause. This genus contains a great many species; but he has made separate genera of several convulsive affections, such as hysteria, tetanus, and epilepsy. Dr. Mason Good's arrangement of convulsive affections is very complicated: they are included in the class *neurotica*. He makes one genus of tonic convulsions termed *entasia*, including tetanus, hydrophobia, wry neck, muscular distortions of the spine, cramps, &c. Another genus of clonic convulsions is termed *clonus:* this includes singultus, sternutatio, palpitatio, nictitatio, subsultus, pandiculatio. A third genus called *synclonus* comprehends tremor, chorea, shaking palsy, raphaneia, and beriberia. His last genus is called *syspasia*, or comatose spasm, in which he places convulsion, hysteria, and epilepsy.

Convulsions have also been divided into primary and secondary; acute and chronic; continued and intermittent, &c.; but these divisions are unimportant, as they lead to no practical end.

There are attacks of simple convulsion, partial and general, that cannot be referred to hysteria, epilepsy, or any of the well-defined convulsive affections which have received generic names. These varieties of simple convulsion will form more particularly the subject of the present paper; and as convulsive affections are generally entitled, by the formidable character of their symptoms and the imminent danger which frequently attends them, to the attentive consideration of the practitioner, we propose taking a general view of their pathology, and of the principles which are to regulate their treatment.

Convulsions may be *local* or *general*; each part may be separately and successively affected, or the whole frame may be convulsed at once: in some cases the convulsive movements are confined to one side of the body. We shall first consider the manner in which different parts of the body may be separately affected with convulsions.

LOCAL CONVULSIONS.—When the eyelids are affected, if the convulsion is confined to the levator palpebræ superioris, the upper eye-lid is forcibly drawn up, and cannot be closed; the eye-ball consequently remains uncovered, and is exposed to painful irritation: this occurs sometimes as a local affection, especially in neuralgia of the supra-orbital nerve. If the orbicularis muscle be affected, the eye-lids are forcibly closed, and can with difficulty be separated. Slight convulsions of the muscles of the eye cause a rotatory motion of the globe from side to side or else upwards. This is a frequent symptom of visceral irritation, especially in children, in whom it often occurs during sleep. When these muscles are more violently convulsed, there is strabismus, or a violent contortion and rolling of the globe in the socket; or else the eye is firmly fixed, staring and protruding. The iris being possessed of contractility is susceptible of convulsive action; the pupil is then either very much contracted and immoveable, or else it is alternately closed and dilated by quick and irregular oscillations. Both pupils may be differently affected, one remaining fully dilated when exposed to light, whilst the other contracts; or one may remain stationary, the other being alternately contracted and dilated. There are in this respect great variations.

The convulsions of the muscles of the face give rise to a great variety of remarkable and opposite expressions. The whole of the features may be fixed and immoveable, or there may be a constant change of expression by the momentary contraction of separate muscles in quick succession; or the convulsions may affect only some of the features, causing, for instance, slight evanescent twitchings of the lips or distortion of the mouth; or else an elongation and drawing up of the commissures of the mouth. This last variety gives rise to a species of convulsive laughter, sometimes closely resembling the smile and laughter of health, especially in infants, but often more violent: this is the *risus Sardonicus* of the ancients. When the muscles of the jaws are affected, there may be grinding of the teeth or a violent clattering of the jaws; or else there is a permanent rigid spasm, rendering the lower jaw fixed and immoveable, as in trismus. Persons of a highly nervous temperament are sometimes affected with an habitual twitching of certain muscles of the face; these generally arise from constitutional causes, and are difficult to be remedied. Convulsions of the muscles of the tongue cause it to be violently twisted in the mouth so as to push out the cheeks, or else it is forcibly protruded; it is very liable in that case to be severely wounded by the teeth, and has in some rare cases been completely cut off. A tremulous state of the tongue when put out is a sure sign of general nervous debility.

When the muscles of the neck are simultaneously convulsed, the neck feels hard, and the head is drawn back; if only those on one side, the head is drawn to that side or partly turned round. There may be, from this cause, either a permanent rigid contraction, or a convulsive agitation, or a simple tremor of the head and neck. These modifications are observed in wry neck and *paralysis agitans*.

Convulsion of the muscles of the pharynx impedes deglutition, and gives rise to spasmodic dysphagia. The convulsions of the muscles of the larynx cause laryngeal dyspnœa and suffocation, and either various alterations or a total extinction of the voice: these are frequently symptoms of inflammatory and spasmodic croup. The sensations of stricture and strangulation in the throat which so often attend hysteria, chorea, hypochondria, &c., are owing to a convulsive state of the anterior muscles of the neck.

Convulsive affections of the muscles of the thorax (the intercostals, diaphragm, &c.,) are sometimes the primary cause of habitual dyspnœa or of violent paroxysms of cough and suffocation, constituting a variety of convulsive asthma. When the convulsions are severe, the breathing is very irregular: there are a few short inspirations and expirations; then a long intermission without any breathing, followed by several deep inspirations, with heaving of the chest and sighing: in some extreme cases the constriction of the chest has been so violent as to stop the breathing altogether and cause asphyxia. This irregular and occasionally hurried breathing gives rise to a corresponding state in the action of the heart, which becomes violently increased; there is a sudden and considerable rise in the frequency of the pulse, which might be mistaken for fever; the circulation subsides, however, with the paroxysm to its natural standard. A convulsive state of the diaphragm gives rise to hiccup, which is sometimes a most distressing and obstinate complaint.

The convulsions of the abdominal muscles cause in some cases a violent retraction and hardness of the abdomen; in some a convulsed agitation of the parietes of the thorax, bearing the closest resemblance to irresistible laughter; and in others a peculiar undulatory motion of the abdomen frequently observed in hysteria. It is not improbable that the globus hystericus depends on a partial convulsion of the abdominal muscles extending upwards to the diaphragm, and the muscles of the thorax, neck, larynx, and pharynx. The late experiments on the causes of vomiting

CONSUMPTION. (See Phthisis.)

CONTAGION, (from *contagium*, *contagio*, *contingo*, *con* and *tango*, Lat.) — By this term is meant the propagation of disease from one individual to another; though it is sometimes used, both in speaking and writing, to denote the matter by which the propagation is effected. In certain cases, those of inoculation, we have perfect knowledge that this propagation is produced by the communication of a noxious matter from the individual first affected to him who receives the disease, and from analogy, and from our inability otherwise to explain the effect on the system, we infer that in all cases of contagion there is a communication of such matter. The body secondarily affected has the property of again generating and communicating to others a similar matter, the disease produced in every case being the same in kind as that existing in the body where the matter causing it is engendered. Diseases thus produced, and possessing the power of engendering such a matter, are said to be contagious, and the matter generated is called contagious matter, or contagion.

All examples of disease produced in one human being by the application of matter derived from another do not come within the scope of this definition. For instance, in the case of certain dissection-wounds, or in the examples related by Mr. John Hunter, of disease produced by the transplanting of teeth, there is no reason to think that the individuals from whom the matter was derived, laboured under any disorder similar to that which was engendered, nor is it ascertained in either case that the disease possesses the power of propagating itself. But were it distinctly proved that either disease possesses such a property, then would it be contagious, though arising from a non-contagious source: for we are not justified in denying that a contagious disease may be generated by other morbific causes than contagion.

Contagious diseases may be divided into those whereof the contagious matter acts only by positive contact between the individuals communicating and receiving the disease, or by its transference in a visible form from one person to another by inoculation; and into those which, though communicable by contact, and in some cases by inoculation, are besides capable of transmission from individual to individual through the medium of the atmosphere. Contagion is therefore immediate or mediate—contactual or remote.

To the former division are to be referred syphilis, gonorrhœa, sivvens, framboesia, itch, porrigo, Egyptian ophthalmia, cow-pox, and probably pellagra and the mentagra of the ancients: to the latter, small-pox, chicken-pox, measles, scarlatina, [?] hooping-cough, [?] plague, typhus, hospital gangrene, influenza, [?] puerperal fever, and, according to the opinion of some persons, yellow fever, and cholera of India. It has been shown, too, by Dr. Wells, that erysipelas occasionally manifests a contagious property. There are two other diseases which were formerly considered contagious, lepra Græcorum and lepra Arabum (elephantiasis). The former is unquestionably not contagious, and from the observations made by the late Dr. Adams in the lazar-house at Funchal, there is every reason to think the latter equally devoid of this quality. Of the two diseases communicable from inferior animals to man, hydrophobia and glanders, it is not ascertained that they may be transferred from one human being to another, which certainly would have been the case with respect to the former, had it possessed the property of remote contagion. The opinion entertained by many veterinary surgeons, that the latter is communicated by contact from horses to the human species, has been amply confirmed by the researches of Dr. Elliotson of St. Thomas's Hospital: whether it be further communicable from one human being to another is not ascertained.

Of the nature of the matter of contagion we know nothing; but attempts have been made to ascertain the laws which regulate its diffusion through the atmosphere. The following are some of the results of these attempts which have been given to the public; although there is reason to think that they do not merit implicit confidence. Dr. Haygarth informs us that in 1777 he began to ascertain by clinical observation according to what law the variolous infection, and, in 1780, according to what law the febrile contagion is propagated. He is of opinion that the pernicious effects of the variolous miasms are limited to a very narrow sphere. In the open air and in moderate cases he supposes that the infectious distance does not exceed half a yard; and hence, he says, it is probable that even when the distemper is malignant, the infectious influence extends but a few yards from the source of the poison. He is of opinion that the contagion of fever is confined to a much narrower sphere than that of small-pox. (Letter to Dr. Percival, p. 8.)

By Dr. Clarke we are informed that the most malignant fever does not render the atmosphere infectious further than a few feet from the patient, or from the contagion preserved in clothes, furniture, &c.; and daily observation, he remarks, confirms the opinion that a person must remain a considerable time within the sphere of infection to receive it. (Report to the Committee of the Newcastle Dispensary, 1802.)

The poison of plague has been said to be so fixed, that to be affected by it requires almost contact, unless the patient's breath be inhaled, by means of which the disease is readily communicated. We have already intimated a suspicion that these restrictions on the sphere of contagion have been imposed with more precision than sound induction warrants; but we believe it may be considered a rule that within this sphere the danger is greater, other things equal, in proportion to the proximity to the patient.

Certain circumstances influence the extent of contagious diffusion. Of these the most distinctly ascertained are atmospheric impurities; for it is ever observed, and we believe it may be predicated of every disease possessing the property of remote contagion, that its contagious matter is propagated to greater distances in a dirty, crowded, and ill-ventilated apartment than in one of which the air is pure; whilst diffused through an atmosphere of the latter description, it is speedily deprived of its noxious properties. The same principle applies to articles of dress and furniture; those which are contaminated with animal secretions and effluvia being much more readily impregnated with contagious matter than those which are clean. At the same time it must be remarked, that the neglect of cleanliness implies the multiplication of foci of contagion from the foul clothes and the presence of the discharges from the bodies of patients, and the accumulation of contagious matter from the neglect of ventilation; and hence, though filthy apartments are hot-beds of pestilence, part only of their effect is to be ascribed to foul air.

Besides these auxiliaries of contagion acting in a limited district, there are others more extensively diffused, of which the influence is important. Some of these are well known, whilst others are cognizable only by their effect on the propagation of disease. The effect of those, the nature of which is ascertained, varies in the case of different contagions. The diffusion of plague, for instance, is favoured by a temperature high within a certain degree; whilst it is checked, if not altogether extinguished, by the cold of winter, and likewise by very high temperatures, such as the heat of certain parts of Africa in summer, as mentioned by Alpinus, and that of the Harmattan winds. Typhus, we know, prevails at low degrees of heat, as likewise do measles and scarlatina; and so of different contagions, we find the effect of temperature on them varies in the case of different diseases. A moist and still atmosphere, may, if we mistake not, be declared favourable to the propagation of all contagious disorders; whilst it is sometimes suddenly checked by strong commotions in the air, such as storms and hurricanes.

But besides these appreciable atmospheric states, which in one way or another influence the diffusion and action of the matter of contagion, there are conditions of the air favourable to its diffusion, or otherwise, of the real nature of which we are ignorant beyond their influence over the propagation of disease. It has occurred to every medical man to see diseases, justly considered contagious, unusually prevalent in one season compared with another, though there may have been no discoverable difference in the atmospheric states to explain this variety in their prevalence; and to see them, on the other hand, decline and finally disappear long ere individuals susceptible of the contagion were wanting, without there having been any appreciable change in the state of the air to account for that in the disease. This atmospheric peculiarity, to which the name *epidemic constitution* has been sometimes applied, occasionally appears to possess a limited locality; for we find a contagious disease prevailing in a town or village, whilst places in the neighbourhood escape, though there is a constant intercommunion between the infected and healthy districts; or such a disease may spread extensively in one town, whilst in another, similar as to the habits and character of the population, and not remote in situation, it may exist, but be by no means so prevalent.

A distinction has been proposed between diseases transmissible from one human being to another, and between the terms applied to them, founded on the influence exerted by atmospheric peculiarities over their propagation. It has been suggested that the word contagious should be limited to diseases which are capable of transmission under any circumstances of the atmosphere, pure or impure, such as measles or small-pox; whilst those which are communicable only in impure or vitiated air, as some have conceived typhus and certain other diseases to be, it has been proposed to designate by the term infectious exclusively. It will be understood that a corresponding distinction is intended between the words contagion and infection. In the first place, it may be remarked that the distinction between the diseases to which the terms are proposed to be respectively applied is hypothetical; for atmospheric impurities and peculiarities appear to have an influence on the transmission of all diseases, and it seems very questionable whether any disease, not in its own nature communicable, is rendered so by such impurities and peculiarities. Again, the words have long been used by medical men, when speaking of the transmission of disease, as strictly synonymous, and they have applied them indifferently to small-pox and typhus; and the attempt to restrict them in an unwonted manner has been productive of confusion, such limitations having the same pernicious effect as needless neologism. It may be remarked, however, that infection, though in the ordinary language of the profession strictly synonymous with contagion when employed to denote the transmission of disease, is used in a sense which the latter word does not admit, that of contamination by any thing injurious to the human frame; for which see INFECTION.

Of the diseases enumerated as contagious, small-pox, measles, scarlatina, and hooping-cough affect individuals but once in the course of their lives; at least this is a very general rule. The privilege of furnishing immunity from future attacks has been claimed, too, for yellow fever; but it seems very questionable whether the exemption afforded by it be of the general nature of that enjoyed by those who have undergone the exanthematous diseases and hooping-cough. It is indeed doubtful whether the comparative immunity furnished by attacks of that disease be any thing more than part of the general seasoning process by which the constitution becomes hardened against the influence of certain climates and their diseases. Were it unequivocally established, yet would it furnish no material evidence in favour of the supposition of this disease being contagious, unless the furnishing of exemption from second attacks were a property of contagious diseases generally, which is not the case.

A period generally intervenes between the application of contagious matter and the occurrence of the disease which it generates, varying in different diseases, and in different cases of the same disease; for instance, in scarlatina this period is said to range from three to five days, but occasionally extends to twenty-one, (*Dr. Maton*, Med. Trans. vol. v. art. xi.;) in measles from ten to fourteen; in natural small-pox from six to twenty-one; and in the inoculated disease from four to eighteen; whilst Dr. Whytt's very unhappy experiment showed the interval for inoculated plague to be only three days. The contagion of typhus is sometimes instantly felt in the system, as in an example which the late Dr. Gregory used to relate in his lectures, of an individual who instantly sickened and became affected with fever on kicking some chaff thrown out of a bed on which a patient ill of fever had lain; and in another mentioned by Dr. Tweedie, in his Illustrations of Fever, of a nurse in the Fever Hospital, who sickened whilst examining the evacuations of a patient, and passed through a most severe form of fever. Dr. Marsh's observations upon the origin and latent period of fever (Dublin Hospital Reports, vol. iv.) abound with striking instances of the instantaneous occurrence of the disease on the application of its cause; but the interval from the application of the poison of typhus to the production of its effect, there is reason to think, extends frequently to three weeks or a month, and even sometimes to sixty-eight days, (*Bancroft* on Yellow Fever, p. 515.) The latent period of the poison of hydrophobia is longer than that of any other disease we are acquainted with. This period in the case of some diseases is not one of perfect health. In that of typhus a great degree of nervousness, inappetency, mental dejection, and debility often precede for days or weeks the symptoms which denote the commencement of the febrile movement in the system. It has occurred to the writer to observe cases in which the low but exhausting degree of indisposition attending this period has constituted the greater part of the disease which has destroyed the patient. He has visited persons who, though they had felt themselves indisposed for weeks, had persevered in their accustomed avocations in spite of this feeling, which they thought lightly of, and have then suddenly sickened with the worst symptoms of the last stage of typhus, and expired within forty-eight hours. An author already quoted, Dr. Marsh, deserves the thanks of the profession for calling their attention to the importance of this period and its proper management.

The most certain evidence we can have of a disease being possessed of a contagious property is its being communicable by inoculation. By this is meant the transference of a visible and palpable fluid, through which we must suppose the subtile matter of contagion to be diffused, from one individual to another, or from one to another part of the same individual. It is designedly practised, as is familiarly known, in small-pox and cow-pox, and also, from improper motives, in purulent ophthalmia. The application of the matter of gonorrhœa to the eye of the person affected with it is an example of the second kind of inoculation mentioned. Inoculation of one individual from another is possible in all cases in which a morbific matter, capable of being transferred by art, is engendered, of which examples in addition to those mentioned may be found in both divisions of contagious diseases. Some disorders, too, which do not during the life of the patient generate a matter which may be artificially transferred, have yet appeared to be communicated in this way by dissection-wounds; a description of cases very distinct from those adverted to of such wounds, in which the individual dissected did not die from a disease of the same nature as that produced in the injured individual.

The other proofs are, repeated examples of persons contracting disease from contact with persons labouring under it, or from being near to them, or from being in the same situation with respect to fomites. An inference may be drawn, too, from the exemption of individuals from a disease who sedulously avoid the sick and fomites, compared with the liability of those who neglect such a precaution. By fomites are meant matters, such as goods of any kind, clothing or furniture, which, having been near the sick, are impregnated with the emanations from their bodies. This may happen to the clothes of individuals who visit them; and in this way an attendant or visiter of patients may communicate a disease to others though he escape it himself, being secured from it in certain cases by having previously laboured under it; in others by insusceptibility of that peculiar contagion, as is frequently exemplified in puerperal fever. It is obvious that the poison may by accumulation exist in a very concentrated state in fomites which have been long near the sick or in contact with them, and consequently we find that some of the worst cases of contagious disease are produced by their means.

With respect to diseases communicable only by contact or inoculation, all doubt of their contagious nature has long ceased; and of those enumerated in the second division, some, which cannot be propagated by inoculation, especially of the exanthematous disorders, are admitted by all observers to possess this property. But respecting others the agreement on this point among medical men is by no means uniform; and controversies have hence arisen as enduring and acrimonious as any recorded in the annals of medicine. The attempts to decide this perplexed question in the case of any disputed disease, must be made in another part of the work; but it belongs to this place to point out the tests, (which owe their value to their being proofs of the circumstances already mentioned, the reception of disease by direct intercourse with the sick, and immunity from it by rigid seclusion from them,) by which any individual case should be tried, and by which alone it can be decided.

1. Contagious diseases frequently spread in places previously healthy, shortly after the arrival in them of persons from infected districts. The same remark applies to fomites. It is the more apt to occur in the case of persons, if they be sick on their arrival or become so shortly after.

2. When a case arises in a limited district, the disease spreads gradually through it as from a centre towards a circumference, but more rapidly, *cæteris paribus*, in proportion to the density of the population, and the intercourse of the healthy with the sick.

3. Persons whose official duties bring them into habitual and close communication with the sick, such as the medical officers and other attendants on public institutions which contain many cases of a disease, are affected with it in a greater proportion than other members of the community similarly circumstanced with themselves, the intercourse with the sick excepted. The number infected from among the different classes of such attendants bears a proportion to the closeness and duration of their communication with the sick;

for instance, the nurses, and in military hospitals the orderlies, are more frequently attacked than the medical officers.

4. The contagious quality of a disease may be inferred from frequent instances of the success of measures taken to prevent its propagation, such as the early removal of the sick. The importance of the evidence to be derived from this source cannot be more clearly shown than by the following statement of Dr. Alison: "We should have little difficulty in pointing out above a hundred houses where a single case of fever has occurred, where the patient has speedily been removed and the place cleaned, and where there has been no recurrence. But we should hardly find five houses in all the closes of the old town of Edinburgh, in which a patient in fever has lain during the whole or even during the half of his disease, in which other cases of the disease have not shown themselves."*

5. Those who seclude themselves from all communication with the sick and with those who visit them, and receive no commodities which have been in their possession or near them, escape the disease; whilst persons similarly circumstanced in all respects, the seclusion excepted, are attacked by it. The same rule applies to countries or districts secluded by quarantine or other regulations from neighbouring countries, similar in soil and climate, where disease is prevailing; though it must be acknowledged that the cases are rare in which a precise conclusion can be drawn from this latter case of exemption.

6. An inference favourable to the supposition of a disease being contagious, may be deduced from the circumstance of there being nothing in the soil or climate where it prevails fitted to engender other causes of disease, such as malaria. A similar inference may be drawn, when disease is prevailing in a limited district, from the cleanliness observed there, and the consequent exemption from infection which might be occasioned by the effluvia from decomposing animal and vegetable recrements. The previous state of health, too, of the district or country, particularly as regards the disease which is the subject of investigation and diseases of the same kind, may furnish the medical reasoner with powerful arguments.

It must be remarked that, in all investigations into disputed cases of supposed contagion, as many tests as possible should be brought to bear upon the points; and that these tests should be secured by a specification of all particulars which tend to show that malaria was not an agent in the production of the disease respecting which the controversy exists. A reference to a few examples of the successful application of the tests will be the best means of putting the reader in possession of the nature of the detail required for the security of his argument.

Those of Dr. Alison have already been referred to, and the reader may be assured that he can consult none more valuable.

In Dr. Tweedie's Clinical Illustrations of Fever the following instance is given of the successful application of the third test, the prevalence of disease among persons officially employed about the sick.

"Every physician, with one exception, (the late Dr. Bateman,) who has been connected with the Fever Hospital, has been attacked with fever during his attendance, and three out of eight physicians have died. The resident medical officers, matrons, porters, domestic servants, and nurses, have one and all invariably been the subject of fever; and the laundresses, whose duty it is to wash the patients' clothes, are so invariably and frequently attacked that few women will undertake this duty. The resident medical officer was attacked with fever, and it became necessary to appoint some one to perform his duties. The first person who thus officiated took the precaution of sleeping at home, yet his duties were soon interrupted by an attack of fever which confined him a considerable time. He was succeeded by an individual in robust health, a disbeliever in the doctrine of contagion. He performed his duty only ten days when symptoms of severe fever appeared.

"There is no security in this narrative, striking as it is, against the favourite argument of the non-contagionists; but the following collateral circumstances present an obstacle to the intrusion of malaria, which only bigotry or the spirit of partizanship can enable it to surmount. The Fever Hospital stands in the centre of a large field, where the production of malaria is exceedingly improbable, and on the same lawn, and within a few yards of it, stands the Small-Pox Hospital; but no case of genuine fever has occurred among the medical officers or domestics of that institution for the last eight years." The relation these facts bear to the argument is sufficiently manifest.

In the case of plague, of the contagious nature of which it would be easy to accumulate proofs, the following example, selected from hundreds, of the influence of fomites, special seclusion from the sick, and close intercourse with them, illustrates well the nature of the evidence to be derived from the third and fifth tests. When the plague was prevailing in Valetta, in Malta, in 1813, the strictest precautions were used by the inhabitants of the Augustine Convent situated in the town to exclude the disease. At length, however, a servant, contrary to regulations, went into a part of the town where the disease prevailed, and purchased clothes supposed to be infected. Soon after he returned he confessed what he had done, and was immediately shut up, together with one of the brotherhood who volunteered to attend him. Both of them were taken ill and died, but no other person in the convent suffered. A disbeliever in contagion would attribute the disease of the servant to exposure to the malaria of the district in which he bought the clothes; but the monk's malaria must have existed in the convent:—how strange that it should have smitten only one of the brotherhood, and he the individual who alone had intercourse with the sick servant!

There can be no better exemplification of the first test than the occurrences in the Island of Ascension in 1823. This island, remote from any other land, of volcanic origin, and the surface untenable. The occurrence of loss of consciousness in convulsive affections will depend on the brain being the seat of the disease, and on the manner in which it is affected; for a slight irritation of the brain, sufficient to excite convulsions, may exist without diminution of consciousness.

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* On Epidemic Fever, Edin. Med. and Surg. Journ. vol. xxviii. p. 241, where the reader will find most of the tests enumerated successfully applied, to show the contagious nature of the fever of this country.

When the exciting cause acts on the brain, the convulsions are likely to be general, although partial convulsions are occasionally traced to some disease in the brain of very limited extent. If the exciting cause is applied to the spinal cord, all those parts receiving nerves from the portion of the cord below the seat of the irritation may be affected with convulsions: and if applied in the course of a nerve, the muscles to which that nerve is distributed will be alone affected; all convulsions produced in this manner may be considered as *primary* or *idiopathic*. But convulsions frequently occur in a very different manner, with respect to the seat of the exciting cause. Instead of its being applied either at the origin or in the course of the nerves, and the irritation being directly transmitted to their extremities, these pulpy extremities themselves receive the first irritating impressions from the various stimulating agents they come in contact with on the surfaces of the organs; these morbid impressions are then transmitted along the nervous fibres to the brain and spinal marrow, which organs communicate the irritation by reflection to the whole frame. The great sympathy of several organs with both the brain and spinal marrow becomes thus a prolific source of general disturbance to the entire nervous system, of which the uterine and digestive organs afford examples in the production of hysteria, and of various other convulsive affections. The convulsions occurring in the manner just described may be termed *secondary* or *sympathetic*. It is very remarkable that pain in any part, sufficiently severe to bring on convulsions, completely disappears during the fit.

The nervous power which acts on the muscles may be produced in excess or in deficiency, or it may be irregularly transmitted. The causes of nervous irritation are extremely numerous. One of the most simple is pressure: when applied mechanically to the brain of an animal, if slight, it causes convulsion; if great, numbness, paralysis, and coma. Pressure on the brain or spinal marrow may be the effect of congestion or inflammation. An habitual determination of blood to the head in people of a plethoric habit renders them very prone to suffer from convulsions. This is frequently the case in puerperal women. Inflammation of the membranes of the brain is generally attended with very violent convulsions, much more so than inflammation of the substance of the organ.

Among the other causes of pressure and irritation are to be reckoned extravasations of blood, the serous effusions of hydrocephalus, organic tumours, bony tumours or spiculæ growing from the inside of the cranium, and injuries of the head with fracture and depression. Causes of a similar nature may affect the spinal marrow. There are other more indirect causes of cerebral irritation. It was observed by Morgagni, with respect to mechanical injuries, that the nearer they were to the head the greater was their influence on the brain; that, for instance, a very slight cut over the orbit was more likely to excite cerebral irritation than a much severer wound in a more distant part. The severe cerebral irritation which sometimes attends dentition may be accounted for on the same principle. Carious teeth are often an active source of cerebral and nervous irritation, and have not unfrequently been the occasion of slight convulsions in individuals of very irritable temperament. The laceration of nerves is a very frequent cause of tetanus, or severe convulsions. It is singular that the muscles to which the injured nerve is distributed may be the last affected with convulsive action; convulsions, however, do not always follow inflammation of the nerves. Convulsions, either local or general, are likewise frequently occasioned by tumours compressing nerves in their course;* by contused and lacerated wounds of other parts, especially of ligaments and fibrous tissues; dislocations, compound fractures, &c., and finally, by intense pain, whatever be its source.

Gastric and intestinal irritation have always been considered among the most active causes of convulsions, especially in children; it may be sufficient to instance the convulsions occasioned by worms, and the distressing cramps so frequently experienced from the presence of acidity in the primæ viæ. We have already alluded to the great influence of the uterine functions on the brain and nervous system, and to their being a most frequent source of nervous irritation and convulsions. This arises in puerperal women from two causes—the distension and pressure of the uterus causing an accumulation of blood in the head, and the high degree of nervous susceptibility which attends the puerperal constitution.

Among the occasional causes of convulsions may be mentioned, exposure of the bare head to the heat of a burning sun; sudden transitions from heat to cold; suppressed perspiration; the suppression of eruptive diseases, such as variola, rubeola, and of many chronic cutaneous eruptions; and that likewise of old sores, and of the menstrual and hemorrhoidal discharges; the retrocession of gout and rheumatism, and of several other diseases. A strong excitement of the external senses sometimes produces great cerebral irritation. Very sensitive women have been thrown into convulsions by the scent of flowers, or by deeply impressive music, or the unexpected sight of an object either of interest or aversion: the effect of the smell of paint on some constitutions is also well known.

Moral emotions may be considered among the most powerful causes of convulsions, particularly when operating upon the sensitive minds of children. This is a point of considerable importance as respects the conduct to be pursued towards them, and the regulation of their dispositions. The exciting and the depressing passions act very differently; the first, as anger and excessive joy, throw the individual into a state of high excitement, causing a determination of blood to the head; the second, as fear, occasion a sudden collapse and prostration of the nervous power. There are numerous instances of an attack of epilepsy, chorea, or even of fatal convulsions, resulting from a sudden fright. Great mental exertion, loss of sleep, excessive anxiety, the abuse of spirituous liquors, by gradually exhausting the nervous energy, create an extreme degree of irritability, which has not unfrequently induced convulsive fits.

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* Sir H. Halford mentioned, in a paper read before the College of Physicians, several cases of severe neuralgia of the infra-orbitary nerve, caused by the pressure of bony tumours within the infra-orbitary canal.

Convulsive affections are very much under the influence of habit; so that even after the removal of the exciting cause, there may be regular repetitions of the attack, in consequence solely of the portion of the nervous system which is affected having acquired a depraved habit. Many curious instances of this description are to be found in medical writings. These habits of recurrence are sometimes not broken off without great difficulty. Another peculiarity of convulsive affections is, that they can be acquired by the mere power of imitation. In sensitive children, and young females endowed with great nervous susceptibility and a lively imagination, the influence of example on the nervous system is very remarkable; the instances of individuals so constituted being seized with an attack of convulsions, chorea, or epilepsy, merely through the shock experienced by witnessing others affected in the same manner, are by no means uncommon. In the history of the dark ages, when superstition and fanaticism had a strong hold of men's imaginations, there are recorded several instances of nervous affections, combined with various hallucinations, having spread like epidemics, from the mere contagion of example. An extraordinary instance of the influence which the strong excitement of religious fanaticism is capable of exercising over the nervous system was seen as late as 1724 in Paris, during the persecution of the Jansenists: after the death of Deacon Paris, one of the highly revered chiefs of the sect, crowds of his followers went in pilgrimage to the place of his burial at St. Medard, where they fell on his tomb, and were apparently seized with the most violent convulsions: they asserted that, after passing through this ordeal, they arose miraculously cured of any disease with which they might be affected; and this practice was continued for a considerable time. Some of his disciples were no doubt impostors; but it is well authenticated that many credulous zealots actually worked themselves into convulsions by the mere power of their imaginations. Willis and several other writers state that convulsive affections of children have occasionally appeared as epidemics. A disease of this description carried off a great many children in Paris at the close of the last century; and it is remarkable that it attacked likewise young dogs.

Convulsions are also frequently produced by narcotic and irritating poisons. To obtain this effect, narcotics must be given in small doses; for if the dose be large, it may at once destroy the irritability, when coma and death will ensue without any struggle. The nux vomica seems to possess the specific virtue of exciting muscular contractility, and has on that account been successfully applied to the treatment of certain forms of paralysis. Most of the mineral poisons occasion convulsions by exciting violent inflammatory action. Exposure to the fumes of mercury and lead produces either a convulsive tremor or complete paralysis, by weakening the nervous energy. The inoculation of the rabid virus is followed by the frightful convulsions of hydrophobia; and most of the other animal poisons have a similar property, though in a much milder degree.

Several of the causes we have enumerated have a direct tendency to excite in the brain or spinal marrow various degrees of congestion or inflammation; and there can be no doubt that in some cases this is the true pathological state of these organs. We must not, however, by any means consider this as the most common form of disease, for in the majority of cases the accession of the paroxysm is not attended by any vascular excitement, and there is merely a state of nervous irritation and functional disorder.

Convulsions are sometimes produced by a state of the brain the very reverse of plethora or vascular congestion; and when it is, on the contrary, deprived of the supply of blood necessary for the continuance of its functions. This often happens after a large and sudden abstraction of blood from the arm, or profuse hemorrhage, and during the last struggles of life. It should be remembered, therefore, that convulsions arise both from an increase and a diminution of vascular action; and that *nervous debility* is the essential character of that state of the nervous system in which they originate: *a repletione aut ab evacuatione fit convulsio.* is one of the aphorisms of Hippocrates. It is also deserving of notice that many of the appearances of vascular turgescence which may be observed in the brain and spinal cord in fatal cases of convulsion, are the mere accidental effect of the violent struggles of the patient in his last moments, the same as occur in all cases of violent death.

In the description formerly given of some *anomalous* convulsive affections, we noticed a variety of disorders of the thoracic and abdominal viscera, combined with great disturbance of the nervous system, and a violent convulsive action of many of the voluntary muscles; we stated that several of the complicated symptoms of those affections might perhaps be accounted for by a reference to the functions of the spinal marrow and of the great sympathetic or visceral nerve. Several ancient writers have conceived that many spasmodic, convulsive, and nervous diseases have their origin in affections of the spinal cord and great sympathetic. This was the opinion of Hoffman, Ludwig, Lieutaud, Burserius, Portal, &c. The functions of these divisions of the nervous system have been more accurately investigated since by Bichat, Legallois, and Ollivier; but the subject still remains involved in much uncertainty. They have made it, however, appear highly probable that many of the diseases of the thoracic and abdominal viscera are to be attributed to morbid conditions of the spinal marrow and of the ganglionic nerves of the great sympathetic. There can be no doubt that the sympathy existing between these two classes of nerves is much greater than is generally imagined; proofs of this are afforded by the great muscular debility of the lower extremities, and the severe cramps, which so commonly attend diarrhœa or dysentery, and chronic dyspepsia; and on the other hand by the attacks of diarrhœa, gastrodynia, and cramp of the stomach, which are frequently the effect of cold and wet feet. In some chronic affections, moreover, of the thoracic and abdominal viscera, a careful examination of the spinal column has led to the discovery of one or several spots excessively tender on pressure, and by applying leeches or cupping-glasses and counter-irritants to those spots, we have seen in several instances severe palpitations of the heart, oppressive dyspnœa, gastrodynia, or great irritability of the stomach, relieved in a very remarkable manner: these are pathological considerations highly deserving of further inquiry.

[The greater part, if not the whole, of convulsive diseases may be referred mainly to the true spinal system of Dr. Marshall Hall, or, in other words, to the grey matter or chain of ganglia in the centre of the spinal cord. (See Dr. Hall's *Lectures on the Nervous System and its Diseases*: Lond. 1836; or, the Physiological Works of Müller, Carpenter; or, the writer's *Human Physiology*, 5th edit. i. 71: Philad. 1844.) In some of the cases, the mischief is in the spinal marrow itself, or is *centric*; but in the large majority of convulsive diseases, it is *eccentric*, or the irritation is conveyed to the spinal marrow by afferent nerves, and the morbific influence is reflected from the spinal marrow by efferent or motor nerves, so as to involve various organs. Strychnia, doubtless, acts *centrically*, or, in other words, upon the spinal centre, when it induces tetanic convulsions.]

Treatment.—In the account given of the pathology of convulsive affections, it is stated that they may originate in a variety of causes differing very widely in their nature, and that they are also considerably modified by age, sex, and temperament. The treatment adopted during the paroxysm must therefore be regulated by a careful consideration of all these circumstances. We must endeavour to ascertain whether the increased irritability of the nervous system, which is the primary source of all convulsions, proceeds from increased vascular action in the brain or spinal marrow, or from mere nervous irritation; and whether the exciting cause has its seat in the brain, spinal marrow, or course of the nerves, or the convulsions are to be attributed to the morbid condition of some other organ. If the convulsions occur in a full plethoric subject, with well-marked symptoms of cerebral congestion or inflammation, fifteen or twenty ounces of blood must be taken from the arm or jugular vein; and this may be repeated in ten or twelve hours, should the symptoms continue unabated; when the strength of the patient no longer admits of general depletion, or when the symptoms of vascular excitement are less urgent, local bleeding by cupping on the temples or nape of the neck may be employed, and in some cases may be conjoined with general bleeding.

In cases, however, depending chiefly on cerebral and nervous irritation, and characterized by a general delicacy of frame, spare habit of body, a pale face, small frequent pulse, irregular hysterical breathing, and other signs of a purely nervous temperament, copious bleeding is highly injurious, and only aggravates the symptoms by increasing the general irritability. There may be intermediate states, requiring a moderate degree of local depletion, the discrimination of which must be left to the judgment of the practitioner. We must also add, that local plethora in the brain and other organs may sometimes exist with general debility, and that paleness and languor should not in such cases deter the practitioner from having recourse to local bleeding; the treatment of such cases requires, however, no ordinary degree of tact and caution. It is very important to bear in mind that the violence of the convulsions is not to be taken as a test of the strength of the patient, for no convulsions are more violent than those which occur after profuse hemorrhage and extreme prostration; and, as convulsions arise probably from mere cerebral and nervous irritation in a considerable proportion of cases, the practice of indiscriminate copious blood-letting in every case of sudden *fits*, so much in favour with the public and a portion of the profession, cannot be too strongly deprecated; the principles we laid down on this subject when treating of coma, apply equally to convulsions.

The application of *cold* is often of great service in convulsive diseases. Cold applications to the head are particularly beneficial, provided they be used assiduously; they may consist of cloths dipped in water and vinegar, or pounded ice put into a bladder; or a still better method is the affusion of cold water over the head, frequently repeated. The cold bath, which has been advised by some, may be suited to robust constitutions, but would be injurious, during the paroxysm, to the weak and irritable; the cold affusion, as recommended by Dr. Currie, is less objectionable, and in cases depending on pure nervous irritation, especially in hysterical females, the shock given by dashing cold water over the body has sometimes cut short the paroxysm, and prevented its recurrence. The same effect has been obtained by free exposure to cold air, especially in children, as recommended by the late Dr. Gregory, of Edinburgh. A free circulation of cool air round the patient is always most desirable.

The application of *heat*, through the medium of the warm bath, is highly beneficial and in very general use; it soothes, relaxes, and acts as a diffusible stimulus. The warm bath is therefore of great service in cases attended with a high degree of general nervous irritation, or in which cutaneous eruptions have been repelled, and particularly when there is a dry rough skin and great rigidity of fibre. The affusion of cold water over the head, whilst the patient is in the warm bath, or stands in warm water, is an excellent practice.

Purgatives have always been classed among the most powerful remedies in the treatment of acute nervous diseases; the operation of a brisk cathartic during the paroxysm has the effect in many cases of immediately subduing the violence of the symptoms, and more especially where they have been induced by a disordered state of the bowels: a combination of calomel and jalap is the most active and efficacious form of cathartic; in patients of a delicate constitution and in children, a preference should be given to the milder purgatives, such as calomel and rhubarb. When cathartics cannot be administered by the mouth, they will act almost as efficaciously in the form of injection. Whilst moderate purging is decidedly beneficial, the repeated exhibition of drastic purgatives, which has been a favourite practice of late years in this country, cannot be too strongly condemned, as tending to induce a state of general exhaustion and nervous irritability similar to that which is the effect of excessive bleeding. No one can have been kept for a few days under the constant operation of brisk cathartics without feeling a considerable degree of languor and irritability. These objections are particularly applicable to the continued use of calomel and other mercurial preparations.

When the primary cause of all diseases was referred to the nervous system, and the various morbid phenomena were attributed to spasm and nervous debility, *opiates* and *stimulants* were largely administered on all occasions, and the death of the patient was often accelerated by over-excitement. In modern times, however, since the doctrines of inflammation have been so generally applied to the investigation of the nature of diseases, and their various symptoms have been referred to morbid conditions of the *vascular system*, practitioners have fallen into the opposite extreme, and laying aside all due consideration of the state of the nervous system, have employed such remedies only as tend to reduce excessive vascular action. In the class of affections under consideration, if the violent agitation of the nervous system continue, after adequate bleeding and purging, the administration of an opiate is clearly indicated, and will often be very advantageous. When prescribed under the circumstances stated, it should be given in large doses.

The external application of laudanum, in the form of frictions, combined with stimulating liniments, is an excellent mode of administering opiates, especially to children. Sometimes the direct application of opium to the skin, after the cuticle has been raised by vesication and removed, has been found a very efficacious method of exhibiting it.

The habitual use of opium creates, as is well known, an extreme degree of weakness and irritability of the nervous system. It has sometimes occurred that after the habit had been long acquired, and the opium has been suddenly withdrawn, the most formidable attacks of convulsions have supervened in consequence of the exhaustion and sinking of the nervous power; the patient must therefore be only very gradually weaned from his indulgence in the use of opium, some other less pernicious stimulant being, if possible, substituted. We have known the spiritus ætheris nitrici and camphor mixture given in such cases with considerable advantage. The above remarks are equally applicable to the abuse of spirituous liquors.

A variety of *antispasmodics*, such as ammonia, musk, æther, camphor, valerian, and other medicines of this class, have been recommended to mitigate the violence of the paroxysm; their powers, however, are so doubtful that they are not entitled to much confidence. These remedies appear sometimes to afford relief by facilitating the expulsion of flatus from the stomach and bowels. It may also be added, that when there are symptoms of acidity in the stomach, alkaline medicines combined with antispasmodics and aromatics may be given with advantage; a teaspoonful of calcined magnesia in some aromatic water has been known immediately to relieve a fit of asthmatic dyspnœa or severe cramps in the lower extremities.

Counter-irritation is beneficial when applied with due moderation; large blisters to the head are decidedly injurious, preventing the application of cold, and having rather a tendency to increase the cerebral irritation; small blisters are therefore preferable, and their revulsive effect is best obtained by applying them to the feet, calves of the legs, the inside of the thighs, or along the spine. Sinapisms and other stimulating poultices may be used in the same manner, or the feet and hands may be immersed in a mustard bath: these simple remedies of former times are too much neglected in the present day.

Convulsions arising from profuse hemorrhage or after excessive bloodletting, are generally attended with giddiness, fainting, dull throbbing, pain in the head, and a tendency to coma; under such circumstances we must have recourse to the administration of diffusible stimulants in small and frequently repeated doses: brandy in warm gruel is the stimulant, perhaps, to be preferred; it may be given alternately with carbonate of ammonia or æther. Whilst the head is kept cool by evaporating lotions, great care must be taken to preserve a due degree of heat in the extremities and on the surface of the body by the usual means.

In cases of convulsions from poisons, the first object will be to evacuate the stomach by the exhibition of powerful emetics, or the employment of the stomach-pump; the subsequent treatment must vary according to the symptoms and nature of the poison, as will be detailed under the proper head. We refer to other articles in this work for the treatment of convulsions occasioned by the action of lead and mercury on the animal economy; the modifications applicable to the treatment of puerperal and infantile convulsions are also detailed in their proper place.

The local treatment required when convulsions are occasioned by wounds of the nerves, or the laceration of any part of the body, will be specified in the article TETANUS. In convulsions depending on organic disease of the brain of long standing, the treatment, it is obvious, can only be palliative.

The regulation of the *prophylactic* treatment is of the highest importance in all convulsive affections, but more particularly in those anomalous, severe, and protracted cases which were described under a separate section. The paroxysms in such cases frequently resist every attempt to subdue them, and little can be done but to mitigate their severity. We stated that these anomalous affections are distinguished by considerable disorder in the functions of the uterine or digestive organs, and by a highly disturbed state of the nervous system, depending on some morbid condition of the brain, spinal marrow, or nervous apparatus of the great sympathetic; and that there is often great difficulty in ascertaining whether the disease originates in a primary affection of some portion of the nervous system, or in the morbid condition of any of the other organs. Our attention should, therefore, be directed, after the removal of urgent symptoms, to the gradual amelioration of the general health, as the most effectual means of overcoming diseased action in particular organs.

Our remarks on the injurious effects of excessive *bleeding* and purging during the paroxysm are particularly applicable to the prophylactic treatment. It has frequently happened that the dull headach and vertigo, wrinkled brow, throbbing of the temporal arteries and carotids, convulsive twitches of the features, watchfulness and restless anxiety, with alternate states of chill and morbid heat, rapid, small, irregular pulse, and subsultus tendinum, which are sure indications of that extreme irritability of the brain and nervous system so appropriately called *cerebral erethism* by Dr. Whitlock Nicholl, have been mistaken for symptoms of inflammation; and this serious error has led to a perseverance in those very measures which have induced and are calculated to aggravate the morbid condition in question. Instances of this description have not unfrequently fallen under our own observation; and a remarkable one is afforded in the case we have quoted from Dr. Abercrombie. Although copious and frequent bleeding may appear to afford temporary relief when there are symptoms of plethora, it increases the laxity of fibre which so strongly predisposes to a plethoric habit. A tendency to plethora in the head will be best counteracted by occasional revulsive bleeding from the lower extremities: as, for instance, the abstraction of a few ounces of blood from the feet by means of leeches, or the opening of a vein, the bleeding being encouraged by immersion in a warm foot-bath. We have found this plan particularly useful in cases of suppressed or irregular menstruation, and by having recourse to it at the approach of the menstrual period, or on the first appearance of any of the symptoms threatening an attack of convulsions, we may often succeed in warding it off.* Bleeding along the course of the spine by leeches or cupping, particularly when there is tenderness on pressure, will sometimes relieve very distressing symptoms of dyspnœa, palpitation, vomiting, and gastrodynia, or partial convulsions of the muscles of voluntary motion; this is a practice hitherto too much neglected. Leeches may also be applied with advantage to the rectum. It ought, however, to be made a general rule not to carry blood-letting to such an extent, with respect either to its frequency or amount, as to impair the general strength, unless there be decided symptoms of inflammation. Counter-irritation along the spine by means of blisters, tartar emetic ointment, and stimulating embrocations combined with opium, has been found a very useful adjunct to local depletion in convulsions depending on affection of the spinal marrow.

Whilst violent purging is to be deprecated, a moderate course of alterative *purgatives*, if judiciously managed, will generally form an important part of the prophylactic treatment. The function of secretion appears to be under the special control of the nervous system, whatever influence chemical affinity or galvanic agency may be supposed to have over the ultimate changes of the blood in the secreting organs: hence it is that in all cases of long-continued disturbance of the nervous system, we find the secretions vitiated, and becoming in their turn sources of irritation: this is well exemplified in chlorotic women, and in chronic mental alienation. The secretions, therefore, in nervous diseases should always be carefully examined, and means adopted to restore them to a healthy state. This is to be principally accomplished by the continued exhibition of mild purgatives for a certain length of time, so as to obtain free and natural evacuations, but stopping short of the irritating and debilitating effects of active purging. We must be guided in the selection, dose, and frequency of repetition of the aperients by the habit of body of the patient, the appearance of the tongue, and state of the stomach, and the nature of the alvine and urinary discharges. We have found a combination of equal parts of the massa pilulæ hydrargyri, pilula rhei comp. and extractum catharticum, produce the desired effects.

Tonic and *antispasmodic* remedies, given either singly or in combination with purgatives, are in general remarkably well suited to that state of the nervous system which predisposes to convulsions. We would observe, however, with respect to this class of remedies, that if given so as to create a high state of habitual excitement, their effects will be decidedly injurious. The practice, therefore, of administering indiscriminately strong doses of ammonia, ether, or valerian, and allowing a free use of wine, to nervous and hysterical women, is often highly improper. We can only expect to do good as far as we can succeed in gradually and permanently increasing the tone of the nervous system. This effect may be fully obtained by moderate doses of some of the tonic and antispasmodic medicines, given for a considerable length of time, in conjunction with gentle aperients. The preparations of iron and bark are the tonics generally to be preferred, for their great efficacy in restoring the tone of the nervous system whenever it has been gradually much impaired. Iron has also the advantage of acting as an emmenagogue, and correcting that deficiency and irregularity in the functions of the uterus which is so often the sole cause of the disordered state of the health: a striking instance of its power in this respect is afforded in the case of anomalous convulsive diseases already alluded to, as quoted from Dr. Abercrombie. We have used with considerable advantage, in similar cases, the carbonate of iron combined in a mixture with carbonate of ammonia and tincture of aloes; it must be given to the extent of between one and two drachms in the twenty-four hours: when carried beyond this dose, it remains accumulated and perfectly inert in the alimentary canal. The preparations of zinc, the solution of arsenic, the nitrate of silver, and several of the fetid gums have likewise been strongly recommended, and may no doubt on many occasions be given with benefit. All medicines acting on the nervous system lose their effect by habit; and it is a good general rule to substitute occasionally one for another.

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* Dr. Prichard, in his able work on Nervous Diseases, has given an excellent account of the convulsive affections which not unfrequently accompany disordered menstruation, and of the mode of treatment; to which the reader is referred for more ample details.

The cold and warm *bath* are still more valuable remedies in the prophylactic treatment of convulsions than during the paroxysm. The daily use of the cold shower-bath, with the feet immersed in hot water, and also cold sea-bathing in summer, tend powerfully to increase the tone of the nervous system. The warm bath or tepid shower bath must be ordered for delicate patients, too sensitive to bear the sudden impression of cold; but it is very desirable to lessen by degrees this extreme susceptibility, by lowering gradually the temperature of the water. We must in general be guided by the feelings of the patient and the vigour of the constitution in the choice of the cold or warm bath. There is a remarkable sympathy between the functions of the skin and those of the brain and nervous system; and it is always of great importance to excite a healthy action of the skin, which is generally dry and torpid, in persons subject to convulsive affections. The natural vapour-baths found in the caverns of the volcanic mountains in the neighbourhood of Naples were in great repute for the cure of convulsive diseases among the Romans, and are still much resorted to by the present inhabitants of the country. We have seen the use of vapour-baths attended with the very best results in some intractable cases of convulsions.

There are few things of greater importance in the treatment of convulsions than the regulation of the *diet*; for a disordered and irritable state of the stomach and bowels frequently operates as an exciting cause. In cases attended with general plethora and a tendency to cerebral congestion, the diet must be very spare; animal food and fermented liquors are to be entirely prohibited, and a milk and vegetable diet, with light broths, prescribed. By persevering in this soothing plan, attacks of convulsions threatening to assume the character of regular epilepsy have been completely overcome. In cases, however, of an opposite description, characterised by languor and irritability, the diet, although simple, should be nourishing.

The moral management of the patient requires attention; pains should be taken to remove him from the influence of every predisposing and exciting cause, such as crowded hot rooms, late hours, sedentary habits, mental anxiety, &c. It is of consequence to provide some occupation or diversion for the idle, in order to withdraw them from the study of their own feelings; as few things tend more to increase nervous irritability than a mind preying on itself. The power of volition over the functions of the nervous system is greater than is generally supposed. When convulsions recur from mere habit, this morbid habit has in some cases been completely broken by a strong and sudden effort of the will: it is advisable, therefore, not to encourage such patients to yield to their feelings by showing them too much sympathy, but rather to remonstrate with them temperately, insisting that they have it greatly in their power to resist the first approaches of the paroxysm, if they will only resolutely determine to exert it. It is quite certain that children have been frightened *out* of convulsions as well as frightened *into* them; and it is by acting on the nervous system through the medium of the imagination, that quacks, soothsayers, and fanatics have acquired such celebrity in the cure of nervous diseases.

ADAIR CRAWFORD.

I. CONVULSIONS, INFANTILE. The present article is intended to include only those convulsive diseases which are either peculiar to the earliest periods of life, or are accompanied with such circumstances as modify the symptoms, and require some peculiarity in the treatment. Convulsions are so frequent in young children, and so often fatal, that it becomes of great importance to consider whether their nature, causes, and treatment are properly understood. Without hesitation it may be stated, that till very recently authors and practitioners were by far too apt to generalize in these cases, and the practice consequently degenerated into routine, and that often on mistaken principles. In most cases the convulsions of young children are symptomatic of some other disease, [or are eccentric;] but although the recollection of this fact is extremely important,—as upon the nature of that particular disease the treatment chiefly depends,—yet there is sufficient danger in the immediate attack to render it proper to give a full history, in the first instance, of the affection itself, the symptoms which are present, and the best mode of alleviating them.

History of the Attack. — Mr. North, in his excellent work on the convulsions of infants, has described various symptoms which may be considered premonitory of an impending attack, independently of the existence of any particular disease, and all of which evince an increased irritability of system. The most striking of these alterations in the child's usual habits are, the starting at very slight noises, a disturbed sleep, with frequent fits of crying from trifling causes, and great peevishness of temper. There is, also, often, a frequent fixing of the eyes, an oscillatory motion of the pupils, a momentary contraction, and again a sudden dilatation of the pupil, and a want of consent between the pupils of both eyes, so that one will contract whilst the other dilates. The countenance is alternately flushed and pale; sudden animation is followed by as sudden a fit of languor, and irregularity in the breathing, particularly with short catchings of the breath followed by long and deep inspiration. Hiccough, too, frequently occurs. The fingers are kept constantly twitching, or the hand is clenched, the thumb stiffly contracted on the palm, the toes drawn in, and the foot and wrist bent downwards. To these symptoms may be often added a peculiar blueness about the mouth, and a pinched countenance. Many of the above appearances, however, are overlooked by the attendants; and often without any warning whatever a convulsion takes place.

In the attack itself there is, says Dr. John Clarke, "a universal spasmodic contraction of all the voluntary and many of the involuntary muscles of the body, accompanied by foaming at the mouth, protrusion of the tongue, staring of the eyes, distortion of the eye-balls, laborious and obstructed respiration, sometimes accompanied with a violent redness of the face and scalp at the beginning of the paroxysm, followed by a purple colour of the whole body at the end of it." This, however, is the history of a severe case: there may be only slight twitchings of the face or of the limbs, with a distorted eye, and bluish circle round the mouth. The limbs may be alternately relaxed and contracted, and only one part or one side of the body may be convulsed at the same time: in some instances this happens alternately with a similar affection of the other side several times in regular succession. As the paroxysm subsides, the convulsive motions become gradually less violent and less constant; the natural colour and appearance returns; the child takes a deep and full inspiration and is then able to cry; and frequently a refreshing sleep succeeds. The attacks may be renewed and again subside several successive times, till perfect relief is obtained; or, on the other hand, even the first paroxysm may be fatal. The convulsions may be momentary, or may last only for a few minutes; or they may continue, with but short intervals, for a great many days. Except the exciting cause of the paroxysm is of such a nature as to be attended with fever or disturbance of the intellectual functions, these characters are not essential to an attack of convulsions.

Pathology.—It has been laid down as an axiom by the late Dr. John Clarke, that "in every case of convulsion the brain is at the time organically affected, either directly or indirectly." As the management of the case depends essentially upon a correct view of this important question, it is highly necessary to investigate its accuracy. Mr. North has very ably exposed the fallacy of Dr. J. Clarke's assumption, and the errors into which a supposed existence of "head affection" has led many practitioners. That the nervous system is implicated in the immediate convulsion is not denied, but that the brain is "organically" affected, or that even a congested state of the vessels of the brain takes place in every case, is extremely improbable. The brain is often in a very opposite state to that of vascular excitement or plethora; being on the contrary, from the continuance of exhausting causes, placed in that condition of "diminished energy of the vital force," which leads to what has been called nervous irritability. The distinction between these two opposite states may be recognised by an observant eye with tolerable facility, and by attending to the previous history and condition of the patient, and to some peculiarities in the attack itself. Where there has been a hot skin, particularly of the head and face, a flushed countenance, a rapid and hard pulse, a suffused red state of the conjunctiva, a contracted pupil, with intolerance of light,—an excited circulation through the brain very clearly exists, probably leading on to inflammatory action. And again, where the child is heavy and stupid, the pupils dilated, the eyes occasionally or constantly contorted, and the power of fixing both on the same object much impaired; the pulse irregular or slow; the veins on the forehead, neck, and scalp, turgid and dark; the countenance bluish; the head large, occasionally hotter than natural; and the *fontanelle permanently elevated and convex*;—a congested state of the vessels of the brain, especially of the sinuses, evidently exists. But on the other hand, it is very common to meet with convulsions where the child is pale and thin, the body wasted by illness or by violent and exhausting remedies, the skin cooler than natural, and the veins on the surface apparently bloodless. In such cases the head, at first sight, looks disproportionably large, but this will be found to be an erroneous impression, arising from the diminished bulk of the body and neck. In this description of case, also, there is a very important guide, (though not noticed in books on the subject,) viz.: the *fontanelle being depressed and concave*. Although there may be drowsiness and stupor, a dilated pupil and squinting, and although during the immediate convulsive paroxysm, by the violence of the muscular agitation, the countenance becomes flushed, the vessels of the scalp loaded, and the fontanelle elevated, yet this condition is only temporary, and any thing but a state of vascular energy or plethora can be supposed possible. The eyes of the profession have been opened latterly to this condition of the brain in infants, as simulating *hydrocephalus*, by the writings of Drs. Gooch and Marshall Hall; and the same valuable observations are quite as applicable to the subject of convulsions. It will be easily understood, therefore, how faulty must be the routine practice of abstracting blood, as a matter of course, in all cases of convulsions. [See Dunglison's *Practice of Medicine*, 2d edit. ii. 222: and his *General Therapeutics and Mat. Med.* ii.: Philad. 1843.]

Causes.—It has been already stated that infantile convulsions, in nearly every case, are to be considered rather as symptoms of other affections, and our mode of treatment must be in a great measure influenced by the supposed cause. It may be doubted, indeed, whether real idiopathic convulsions ever occur. These causes are so numerous that it would be nearly impossible to enumerate them all, and many can only be just alluded to, as the diseases themselves are treated of in other parts of this work.

From the first moment of birth a child is liable to convulsions, from pressure on the head during labour, or from mechanical injury in an artificial delivery; and there is not a malady which can occur during the early period of infancy which may not give rise to an attack. Retention of the meconium, stoppage of the urine, an ill-conditioned state of the umbilical cord after division, an irritable, relaxed, or loaded state of the bowels, a full stomach, air in the intestinal canal causing painful gripings and oppression, improper food, a strong glare of light, and loud noises, are amongst those causes which are most apt to occur in the first few weeks of infant life. As soon as the process of teething commences, from the great irritation and often febrile excitement produced, convulsions are liable to be brought on with every tooth, as it makes progress through the gums. Worms in the intestines frequently excite convulsions, their presence in the body being distinguishable by the usual symptoms. The sudden drying up of cutaneous eruptions, or of discharging sores behind the ears or upon the head, without keeping up at the same time a free evacuation from the bowels or elsewhere, is occasionally followed by convulsive attacks; and the onset or sudden suppression of measles, small-pox, or any eruptive febrile diseases, is often accompanied by them. A fit of hooping-cough will often terminate in a regular convulsion from the violence with which the blood is driven to the head, and the difficulty with which it circulates through the lungs. The frequent improper drugging of children with ardent spirits, or patent medicines containing opium, for the purpose of keeping them quiet and procuring sleep, keeps the tender nervous system of an infant in such a state of irritability, that convulsions will very probably supervene; besides the chance of an over-dose at once inducing an attack. Convulsions may occur from mere pain, however caused, if severe and long continued,—the degree of pain required of course depending on the condition of the child at the time, as to an irritable or a plethoric state of the brain. In the same way, sudden frights, violent passions, fits of crying or of coughing, and any rapid rotatory motion, may be causes of attacks. Blows on the head, concussions of the brain, organic lesions of that organ, tumours, bony deposits, or coagula within the cranium, inflammation of the membranes, and either chronic or acute hydrocephalus, must also be enumerated among the causes of convulsions.

Infantile convulsions have been stated to be sometimes epidemic, but as Mr. North has very properly observed, it would be more correct to presume that from local causes some epidemic disease had prevailed, of which convulsions were symptomatic.

Prognosis.—In prognosticating the result of a convulsive attack, regard must be chiefly had to the causes, if they can be ascertained, the possibility of removing them being the ground on which we should rest our opinion; but though this will be our safest guide as to the probability, it must always be recollected that any single paroxysm, if severe and long-continued, may be fatal: we must also be partly guided by the constitution of the child; a very irritable constitution will be thrown into convulsions by much slighter causes than one more robust and of a less degree of susceptibility; the prognosis, therefore, in the latter cases should be more guarded.

Treatment.—The treatment of the immediate attack is generally well understood, even by mothers and nurses. The great point perhaps is not to attempt too much. A warm bath is usually the first thing tried, and will often alone be sufficient to abate the paroxysm, but is not to be used indiscriminately. [There is generally, however, so much hurry and confusion, and the warm bath is, withal, attended with so much inconvenience, that it has been abandoned by many. By some, friction with a warm flannel is substituted for it.] Other means are—dashing cold water on the face and head, wet cloths or pounded ice constantly applied to the scalp, [or to the neck and spine; (R. B. Todd, *Lond. Lancet*, April 30, 1842.)] clysters of aromatic distilled waters, or of assafœtida, combined with castor oil or the neutral salts; chafing the hands and feet with brandy or æther. Should the abdomen be distended with air, which is very commonly the case, a few drops of sal volatile may be given in peppermint-water, and the belly rubbed freely with the hand, or with any gently stimulating liniment. A purgative of an active character, consisting of calomel with jalap or scammony, may be given if the child can swallow; or, should any improper article of food have been recently taken, an emetic should be administered. It is not always possible to collect accurate information on this point at the time, for it does not always follow that the offending aliment should have been very recently eaten. The writer attended a case where, vomiting being excited, immediate relief was obtained by the expulsion of several undigested raisins, which had been given to the child (four years of age) nearly a week before. It is the constant plan of some practitioners to abstract blood in all cases of convulsions in young children; but, as we have shown already, this is not to be defended in all cases by reason, nor does experience justify the practice. Where, however, a plethoric or too energetic condition of the vessels of the brain obtains, it is undoubtedly desirable to relieve the head by bloodletting. Very often, where there is an obstinately constipated state of the bowels, purgative medicines will not succeed in removing some offending matter from the intestines until cerebral pressure has been removed by taking away blood from the neighbourhood. For this purpose, opening the jugular vein is the readiest and perhaps the most effectual method; or, should it be preferred, cupping, or the application of leeches on the temples, or behind the ears, may be had recourse to. The quantity of blood drawn must depend on the strength of the child and the violence of the symptoms; and although on the whole, under such circumstances, children of a tender age bear the loss of a larger quantity of blood than would be supposed, very safely, yet care must be taken lest the child be brought into that state of exhaustion in which convulsions are very apt to occur from an exactly opposite cerebral condition. The writer of this article saw a plethoric child, of a year old, cupped to fainting during a severe convulsive attack, and no sooner had the faintness subsided, and the child was left bleached, with a *depressed* fontanelle, than a second and still more violent convulsion took place, from which it was with extreme difficulty recovered. Should the child be of an age at which the process of dentition would be at all likely to be going on, we should be overlooking a very essential part of the treatment if the gums were not to be freely and extensively scarified: long before a tooth is near the surface this is often of great service, and removes one of the most frequent causes of irritation. Should the case be one of great irritability of brain without plethora, after attacking the exciting cause where it is possible to remove it, should the convulsions still continue, antispasmodic medicines may be liberally administered, such as the assafœtida mixture, ammonia, camphor, æther and musk, and even opium; but from the uncertain effects of the latter medicine on very young children, this must be done with great caution. Where there has been a very irritable state of the bowels, opium is particularly useful when combined with chalk and aromatics; the pulvis cretæ compositus cum opio of the Pharmacopœia is a convenient form, from the small quantity of the opiate which it contains; from one to ten grains may be given, according to the age of the child, and repeated every hour or two, till the desired effect is produced. Most of the advertised *convulsive powders*, as they are termed, consist of chalk combined with musk and aromatics. In some instances, and not always in very weak and exhausted children, there is constitutionally an exceedingly irritable state of the nervous system, leading to convulsions resembling those of an epileptic nature. In these cases, tonics of a very decided character, iron for instance, have been found by the writer sometimes as useful as they have been long known to be in a more advanced age. A child *two months* old, large and fat, was seized with violent convulsions suddenly, the bowels having been disordered from bad breast-milk for a few days previously. The convulsions lasted for *seventeen days*, sometimes occurring three or four times in an hour, and never ceasing for more than four or five hours at a time. The fontanelle was depressed and concave always in the intervals of each paroxysm, and no blood was taken in consequence; the treatment consisting of antispasmodics, external applications, clysters, purgatives, and also of opiates, one drop of laudanum having been administered every hour for a considerable number of doses. This treatment was pursued for a fortnight with no permanent improvement. On the seventeenth day the bad success of the previous remedies induced the writer to try the carbonate of iron, of which five grains in honey were given every two hours for two days. After the second dose the face became florid, the fontanelle elevated, and the convulsions ceased. In the intervals of the fits the child took copiously of breast-milk, by means of a spoon, during the whole period. The infant remained well for a twelvemonth, and then died from hooping-cough.

[In the asphyxia, occasionally seen in the convulsive fits of children, it has been advised to practise artificial respiration by breathing into the mouth of the infant from the practitioner's own, closing its nostrils, compressing the thorax after each inflation, and observing the natural periods of frequency as nearly as possible.]

When the immediate paroxysm of convulsion has been subdued, its recurrence must be carefully guarded against by attentively investigating the state of the child's health up to the time of the seizure, and also avoiding and removing what may appear to have been the remote cause of the immediate attack. It is too much the fashion in all cases where fits have occurred, at once to begin a system of starvation and depletion. It is obvious that this plan can only be adapted to the cases where there are evident signs of plethora or of determination of blood to the head. Where exhaustion and emaciation already exist, a carefully graduated strengthening plan, both of diet and medicine, becomes proper, and, united with quiet, and a change to a purer atmosphere, will often answer our most sanguine expectations. It would only be useless repetition to detail the treatment proper to each of the many causes of convulsions enumerated above; we refer to the different disorders under their respective heads. It will be sufficient to recollect that when once children have been seized with convulsions, they are very likely to recur, even from causes very dissimilar to those which produced the first attack; the brain remaining more susceptible than before. Every thing which may add to this susceptibility should be carefully avoided; the bowels should be regulated, the diet narrowly watched, both as to quantity and quality, the exercise kept within bounds, heated rooms and late hours interdicted, and even the moral and intellectual education should be conducted with reference to this condition of brain,—too great and too frequent mental excitement being highly pernicious.

Before concluding this article it is proper to notice that very young infants are often affected with what nurses call "inward fits." In these cases there is a rolling about of the eyes when asleep, a drawing down of the mouth with slight twitchings, frequent smiling during sleep, and occasionally a little blueness about the mouth. These symptoms are owing generally to distension of the stomach and to flatulence, and are easily dispelled by frictions on the stomach, back, and bowels, or a little sal volatile, or some of the aromatic distilled waters.

There is a convulsive affection of a very peculiar character which attacks very young children, and was described first by Dr. John Clarke, in his Commentaries on the Diseases of Infants. It has been named "*cerebral croup*," "*spasm of the glottis*," "the *crowing convulsion*," &c. The particular account, however, of this interesting disease, will be found in a separate article. See Glottis, Spasm of.)

[A peculiar form of convulsions has been described, which consists in bobbings of the head forward. These are slight at first, but in process of time they may become so frequent and powerful as to cause a complete heaving of the head forwards towards the knees, and then immediately relaxing into the upright position,—something similar to the attacks of emprosthotonos. (J. W. West: *Lond. Lancet*, Feb. 13, 1841.) The child does not lose its consciousness. Sir Charles M. Clarke, who had seen four cases of it, from the peculiar motion of the head termed it *Salaam Convulsion*. In some of the cases that have lived beyond the age of puberty, idiotcy has occurred. The pathology of the affection is unknown. As remarked by the writer elsewhere, (*Practice of Medicine*, ii. 224,) it would be curious to observe, whether the lesion give any countenance to the views entertained by Magendie in regard to the cerebral seat of the forward impulsion, referred to under Chorea, (q. v.)]

C. Locock.

II. Convulsions, Puerperal. In a work not professedly devoted to midwifery, a notice of this formidable occurrence must of necessity be brief.

History of the Attack.—The real puerperal convulsions can scarcely be mistaken for any other disease, and when once seen and recognised are not likely to be soon forgotten. They may occur not only during the process of parturition, but also in the latter period of pregnancy, and again in the first few days after delivery. They are generally ushered in by certain precursory symptoms; but sometimes there is no warning whatever, or one so slight as to have escaped the notice of the attendant. Usually, however, preceding the attack there is dull pain and weight in the head, constant drowsiness, flushed countenance, with a full slow pulse, and partial or occasional failure of sight. At other times, or in other cases, the preceding symptoms are succeeded by sudden and most acute pain in the head, loss of sight, or the sensation of dark, or of bright, fiery objects moving before the eyes, ringing in the ears, and generally sickness, with pain and oppression at the pit of the stomach. The patient is then seized with twitchings of the face or a rigid contraction of the jaw, followed immediately by violent universal convulsions, resembling in many respects an attack of epilepsy. The face is distorted, the tongue protruded, with foaming at the mouth, and a peculiar deep hissing noise from breathing sharply through the closed teeth; the eyes are fixed or rolling irregularly, the pupils dilated, and the limbs are strongly and convulsively agitated. After a time the paroxysms terminate in stupor, with stertorous breathing, from which, after an uncertain interval, the patient will often awake suddenly, unconscious of any thing which has passed, and apparently well: shortly after, perhaps, the convulsions again return, and several successive fits of a similar character may recur. Apoplexy occasionally follows, and the patient may then die in the comatose stage; but this termination is not frequent where proper curative means have been employed. The occurrence of apoplexy may be considered rather as an accidental complication, not by any means necessarily attendant upon the disease.

Causes.—The immediate causes of puerperal convulsions are often very obscure. They appear sometimes to depend upon a loaded state of the vessels of the brain; at other times the brain appears to be influenced by distant irritation, either in the uterus or in the digestive organs; and again, in some cases, puerperal convulsions are induced apparently by a peculiar irritability of the nervous system. It has been remarked that there has been a greater disposition to puerperal convulsions in those patients who have been in early life subject to convulsive attacks, particularly of an epileptic character; and also in those who have suffered similarly in former labours, and have omitted those measures usually employed as precautions. That the uterine organs are in some way particularly implicated, is evident from the convulsions being of a character which may be said to be peculiar to the state of either pregnancy or parturition.

The immediate attack may be brought on by a loaded or disordered stomach, or by food, however small in quantity, of an indigestible kind. Some substances, shell-fish for instance, have been found very frequently to induce convulsions in the puerperal condition, when at other times they may have been taken by the same individual with perfect impunity. A sudden fright, afflicting intelligence, or any unexpected or depressing mental emotion may excite the paroxysm; hence it has been long remarked that unmarried women are more particularly likely to be sufferers from convulsions, from the circumstances of shame and distress under which their children are usually born. The violent straining caused by labour-pains, and even the disturbance of the frame by the earlier uterine contractions, causing a temporary rush of blood to the head, will sometimes bring on convulsions.

It must be recollected that although convulsions occur most commonly under the circumstances described, they occasionally take place also in a very exhausted state of the frame, when the system has been nearly drained of blood by excessive uterine hemorrhage, or other depletions. In these instances there is generally considerable danger, partly from the great irritability consequent upon the exhaustion, so that much slighter causes will produce more violent effects, and partly from the greater difficulty of applying remedial measures. In these cases the pulse is rapid and weak, and the countenance pale and bloodless. Half a century ago, puerperal convulsions were much more fatal than at present; for we are told by writers of the period, that upon an average, full half of the patients died; whereas now, as is well known, when properly treated, they usually recover.

[From the reports of different observers, collected by Dr. Churchill, (*The Theory and Practice of Midwifery*, Amer. edit., by Professor Huston: Philad. 1843,) it would seem that about one case in four has terminated fatally; although this is doubtless more than the average. Examination after death throws little or no light on the pathological condition. Often, nothing morbid has been perceptible. At other times, there has been hyperæmia or effusion of serum. The neurine is doubtless affected, but in a manner at present not appreciated. The disease is, in other words, a neurosis.]

Treatment.—This is to be regulated especially by noting the cause of the particular attack. As a general rule it may be stated, that copious abstraction of blood in a large stream is the most efficient means of shortening the attack and securing the safety of the patient. Where the pulse is strong and full, and the frame robust, the quantity that may be taken with impunity and advantage is often very great; and where from circumstances it is difficult to procure a sufficient supply from the arm, the temporal artery may be opened, or cupping-glasses applied behind the ears or on the temples. [Advantage, too, may accrue from compressing the carotid arteries in the manner advised for several convulsive affections, (*New Remedies* 4th edit. p. 188: Philad. 1843.)] An active purgative, as scammony, senna, or jalap, combined with calomel in a full dose, may be given; or if there is a difficulty in swallowing, one or two drops of the croton oil may be smeared upon the back of the tongue. An injection of a stimulating and purgative character may also be thrown into the rectum; and for this purpose nothing perhaps is more effectual than turpentine. Cold washes, or bladders containing pounded ice may be applied to the head, and hot mustard poultices to the feet. The propriety of repeating the bleeding, and the time of doing so, either locally or generally, must depend upon the power of the patient and the state of the pulse as well as upon the continuance of the symptoms. In the comatose state, or in what may be called a more chronic stage of the disease, blisters to the head or to the back of the neck may be of service, but they are scarcely admissible previously. In this stage a free action should be kept up from the bowels, and the turpentine enemata are especially useful. For some considerable time after the immediate symptoms are subdued, the patient must be kept perfectly quiet, all causes of irritation must be avoided, and the diet should be spare and simple.

[Whilst it is deemed advisable to diminish the quantity of the circulating fluid, the patient should abstain as much as possible from watery drinks, inasmuch as under the copious draughts from the circulating system, they would not fail to pass readily by imbibition through the coats of the bloodvessels, and supply the loss that had been sustained.]

Where the patient has been, before the attack, much reduced from exhausting illness, or from hemorrhage, we are not always to think it necessary to bleed, and to bleed furiously. Bloodletting must in such cases be had recourse to with very great circumspection; and if necessary at all, local bleeding, with the other remedies mentioned above, is all that we should venture upon. It is well known that dogs have been bled into convulsions, and it is probable that a similar condition of circulation in the brain exists in the cases now referred to. There has been much discussion as to the propriety of giving opium in puerperal convulsions, some having spoken very highly of its advantages, while others have decidedly thought it pernicious; but this difference of opinion has arisen solely from the want of distinction between the character of the cases to which it is or is not applicable. Experience of this fact has led the writer of this article to believe, that whilst opium is certainly injurious in puerperal convulsions of the class first described, it is often, especially when combined with full doses of camphor, most salutary in the latter, as well as in those cases of an hysterical character presently to be mentioned. From one to two grains of opium, with four or five of camphor may be given, and repeated every hour or two till the proper effect is produced; and in the exhausted cases described, the desired effect is to subdue the paroxysms, strengthen and steady the pulse, and restore colour to the countenance. Another point of dispute has been, whether emetics are appropriate remedies in these attacks, — the doubt arising from the supposed bad effects likely to occur from the violent efforts to vomit causing the blood to be impelled more forcibly to the head. Where the attack has been produced by a loaded stomach or by indigestible food, spontaneous vomiting has often happened with great and sudden relief to the patient, and in such cases, but perhaps only in such, benefit will often arise from seconding the natural efforts by administering an emetic.

The last inquiry of importance is, ought we to deliver immediately in all cases of puerperal convulsions where the child or the placenta still remains in the uterus? This is rather a question of experience than of reason; for although it may be said that the presence of the child or the placenta in the uterus may keep up the exciting cause, yet it is well known that convulsions will often occur at a considerable interval after delivery has been completed; neither are they always relieved by emptying the uterus, where they have begun before or during labour. Many object to any artificial hastening of the birth, unless the child's head is within reach of the forceps, on account of the uterine irritation produced by the process of dilating the os uteri, to turn the child and bring it down by the feet. It may be stated generally, that the most experienced practitioners have agreed, that it is advisable to deliver, either by turning or the forceps, (whichever may be applicable,) whenever the parts are in a state to permit this to be done without much difficulty.

It may be proper to add to this account, that where convulsions have occurred in a former confinement, it is very desirable that in any future pregnancy the patient should be closely watched towards the latter part of the time: great quiet should be enjoined, the bowels should be kept regularly open, and the diet be spare; and should symptoms of general plethora appear, or of determination of blood to the head, bleeding is to be had recourse to.

There are occasionally puerperal convulsions of a less formidable character than those above described, — unless indeed they be mistaken for them, — and which consists rather of unusually violent paroxysms of hysteria than of proper convulsions; as, however, they may occur during, or shortly after parturition, they are very frequently confounded with them, and treated accordingly. The distinction may be easily recognised by the absence of stertor and perfect coma, by the great quantity of flatus discharged from the stomach and heard rolling about the intestines, by the globus hystericus, and by the rapid and remarkably contracted pulse during the fit, which becomes slower and more expanded in the intervals. The limbs, and particularly the body, are as strongly agitated as in the real puerperal convulsions, but the face is much less so. As it is too common for inexperienced practitioners to consider all convulsions connected with the parturient condition as alike, and to treat them on that supposition, it is important that these distinguishing marks should be accurately recognised, particularly as, although not uncommon, these cases have been scarcely noticed in works on midwifery. There is no necessity in these instances to bleed the patient, or to proceed to delivery, if that has not already taken place. All that is required is the free administration of the customary antispasmodic medicines, camphor, æther, ammonia, assafœtida, &c.; and in such cases opium or any other narcotic may be safely and beneficially exhibited. Cold water should be freely dashed upon the face, and much advantage will be obtained by warm frictions and stimulating applications freely applied to the stomach, bowels, and spine, which produce or assist the expulsion of flatus from the stomach, with great and rapid relief to the patient. Perfect quietude of mind and body is afterwards very important.

C. LOCOCK.

CORYZA, *nasal catarrh*, *gravedo*, or *cold in the head*, as it is variously termed, is an inflammation and altered secretion of the pituitary or mucous membrane, lining the nasal fossæ, usually arising from cold. Although considered a trivial disorder, there are very few, short of severe pain, capable of producing more bodily discomfort. As this is, however, commonly but of short duration, it is chiefly on account of the coughs and bronchial affections to which it frequently leads, that coryza claims our attention.

It begins with a sense of fulness and obstruction in one or both nostrils, accompanied with the secretion of a thin colourless fluid. This flux comes on in an increased quantity from time to time, and the increase is always attended by aggravation of the uncomfortable feelings of fulness; whilst frequent sneezing, titillation in the nares and fauces, and a copious flow of tears from the full and injected eyes, show an acrimony in the discharge as well as an increased sensibility in the pituitary membrane. This property of the humour is further proved, in the progress of the disease, by the redness and excoriation of the end of the nose and the skin above the upper lip; and it may be considered a remarkable feature in the character of the inflammation. The sense of smell is always impaired, often entirely destroyed, and that of taste usually suffers more or less. Headach is a very common attendant; it is principally confined to the forehead, and accompanied with a feeling of weight and heat over the brows. The partial or complete obstruction of the nasal passages, although caused entirely by the tumefaction of the membrane, gives the feeling of their being plugged up by something, which induces frequent and ineffectual attempts to remove it by blowing the nose. From the same cause the voice is rendered thick and nasal. If the attack is severe, there is frequently considerable pyrexia, with loss of appetite, and pain of the limbs, and in almost every case there is an unusual feeling of chilliness and susceptibility of cold. The disorder is at its height generally about the third day, and then it begins to decline; the flow from the pituitary membrane becomes more scanty and viscid, the swelling and obstruction abate, while the headach and other symptoms are proportionately relieved. Between the fifth and the seventh day the disorder is entirely removed. Not unfrequently, however, fresh cold is taken from the slightest cause, and the coryza, with its attendant symptoms, is kept up for a longer time; and as long as the secretion is copious and thin, no amelioration of the other symptoms takes place. A very common consequence of the diminution of the coryza is the transfer of the inflammation to the mucous membrane of the trachea and bronchi, and, in fact, there are few cases of cold in the head which are not followed by more or less cough.

Causes.—The usual cause of coryza is, as we have before remarked, cold applied generally or locally, and it is the more likely to produce it, if the cold be applied to a part of the body in a state of free perspiration. But a sudden transition from cold to heat seems to be likewise capable of exciting it. A slight form of coryza may be caused by the contact of smoke or other irritating vapours with the nostrils; but this does not bear the same character. Coryza generally accompanies measles, and sometimes small-pox and scarlatina. It is likewise a principal part of the epidemic disease called *influenza*. Whether excesses of diet are really capable of exciting coryza, or whether, as is more probable, they only act as strongly predisposing causes, it is certain that a sore throat, passing into a cold in the head, is a very common sequel of a debauch. It is commonly imagined that a cold in the head is rather a sign of strong health than otherwise: this is only so far true, that, in those liable to it, the cold affects a part of less importance; whereas if the lungs, the tonsils, or the bowels are naturally delicate, the application of cold is more likely to produce disease in these parts. Liability to take cold in any way must certainly be considered as a proof of weakness of the constitution, and where it exists in a great degree, such a succession of colds sometimes attacks an individual, that for months he is not free from the uncomfortable symptoms of coryza. Such protracted cases it is proper to separate from those chronic cases of profuse pituitous secretion, or *phlegmorrhagy*, [*blennorrhœa*,] which are sometimes met with, affecting the nasal membrane in the same way that pituitous catarrh attacks that of the bronchi. In these there is no inflammation, and the diseased secretion does not possess those irritating properties that are so characteristic of acute coryza. Nasal phlegmorrhagy, as some French writers term it, attacks those of debilitated and leucophlegmatic habit, and sometimes comes on periodically. The flux is occasionally very abundant, and we have known it sufficient to wet five or six handkerchiefs in two or three hours. In the intervals there is a cessation of secretion; but, as in pituitary catarrh, (into which it is apt to pass,) the membrane is generally left somewhat tumefied.

When coryza attacks infants, it sometimes so completely obstructs the nostrils as to interfere with the process of sucking the breast, in which nasal respiration is necessary. The child leaves off repeatedly, and becomes purple in the face, and fretful in a few seconds after each time that it takes the nipple. In such cases it becomes necessary to feed the child with a spoon.

Coryza does not lead to suppuration. Pus is sometimes secreted by the nasal fossæ, but not in consequence of the coryzal form of inflammation, which terminates by the secretion becoming viscid, and then opaque, and then of a dirty greenish or yellowish colour, after which it returns to its natural state.

Treatment.—The coryzal inflammation does not require bleeding or any extensive evacuation. An aperient, followed by a diaphoretic, in strength proportioned to the severity of the symptoms; the pediluvium at night, with water as hot as it can be borne, which the addition of a little mustard will render still more effectual; abstinence from all kinds of stimulating food; and confinement to bed to keep up cuticular exhalation, are the measures generally resorted to; and if they have not the effect of shortening the duration, they certainly mitigate the symptoms of coryza. It is the common practice to drink copiously of tea, gruel, or some other diluent, during a cold: as long as this promotes perspiration it is of some utility, and although it augments the flow from the pituitary membrane, it has the effect of diminishing its acrimony by dilution. It is the acrimony of this discharge which re-acts on the membrane and keeps up the inflammation and its accompanying disagreeable symptoms. On this circumstance depends the efficacy of a measure directly opposed to that just noticed, but to the success of which we can bear decided testimony, —we mean *a total abstinence from liquids.* To those who have the resolution to bear the feeling of thirst for thirty-six or forty-eight hours, we can promise a pretty certain and complete riddance of their colds, and, what is perhaps more important, a prevention of those coughs which commonly succeed to them. Nor is the suffering from thirst nearly so great as might be expected. This method of cure operates by diminishing the mass of fluid in the body to such a degree that it will no longer supply the diseased secretion. Any thing that may contribute to reduce the quantity of fluid in the body will assist in the plan of cure, and shorten the time necessary for it to take effect. It is, therefore, expedient to begin the treatment with an aperient, followed by a diaphoretic, as is usual, and this is the more necessary when any fever attends; but beyond this no further care need be taken, and the individual can devote himself to his usual employments with much greater impunity than under the ordinary treatment. The coryza begins to be *dried up* about twelve hours after leaving off liquids; from that time the flowing to the eyes and fulness in the head become less and less troublesome; the secretion becomes gelatinous, and between the thirtieth and the thirty-sixth hour ceases altogether: the whole period of abstinence needs scarcely ever to exceed forty-eight hours. It is then as well to return to the *moderate* use of liquids, as the first indulgence is apt to be excessive. It is not necessary to limit the solid food any more than to that which is plain and simple, except where there is acceleration of the pulse or gastric irritation, in which cases animal food should be proscribed. For the sake of comfort in mastication, the food should not be of the driest kind. Thick puddings and vegetables, with or without meat, will be the best dinner; and toasted bread, or biscuit, *merely moistened* with tea, or other liquid, for other meals. A single cup of tea is enough to bring back the coryza immediately, after twelve hours' abstinence has removed it. We doubt not that it will be said that this plan of cure is worse than the disease; and so it may be in some instances. It may be called always a choice of evils; but we do not believe that any one who is liable to severe colds, after once experiencing the amount of good and evil resulting from this method, would hesitate between them; and it is for them that we make it known. We have never witnessed any evil from this abstinence from liquids for the time prescribed; but it is not unlikely that it may do harm in persons with irritable stomachs, or in those liable to urinary disorders. Moderation in liquid food, which may be assumed as a corollary from what has been already said, is one of the best preventives against the bad effects of exposure to cold. When there is a large quantity of liquid in the system, there must be increased perspiration, and, therefore, greater risk from the effects of cold.

Chronic coryza, or nasal phlegmorrhagy, is a disorder which arises from deranged digestion, or some other functional ailment that has a tendency to diminish the tone of the fibre. It generally attacks elderly people, and in all respects resembles pituitous catarrh of the bronchi, with which it is often vicarious.

C. J. B. WILLIAMS.

COUNTER-IRRITATION (from *contra* and *irritare*). This term, which is of recent introduction, has been adopted in medicine to designate any irritation artificially established with a view to diminish, counteract, or remove some other irritation or inflammation existing in the body.

Counter-irritation is generally applied on the external surface of the body; and although some external medicines, as purgatives, emetics, &c. probably in part owe their efficacy to the counter-irritation which they cause, we shall here restrict our attention to external counter-irritation.

To understand and determine the value of counter-irritation in the treatment of disease, it is necessary to inquire into the principles of its curative influence, and the laws of those actions on which that influence depends. Unhappily this inquiry is restricted by the limits of our knowledge on the subject of inflammation and irritation in general; but enough information may be gathered to regulate in a general way the employment of this remedy in practice.

Nature not rarely cures diseases by counter-irritation; and it was probably from her example that art first adopted the practice. It is a common case to see an inveterate functional disease subside on the appearance of a cutaneous eruption. This more frequently occurs in sub-inflammatory affections of the mucous membrane; but examples are not wanting in which mania, paralysis, chorea, and various other diseases have been similarly cured. The exanthematous and other eruptive diseases are probably cases of a somewhat analogous description; for whether the eruption be the direct result of a curative *molimen*, or effort of the constitution, or proceed from the peculiar affinity of the skin to a virus or morbific cause wandering in the body, its occurrence is within certain limits salutary. This is proved by the relief manifestly afforded to the internal functions, and sometimes by the moderation of the fever, on the external eruption of measles, small-pox, scarlatina, erysipelas, &c. Sometimes, it is true, the fever is increased by this event, and all the symptoms may in consequence assume a worse aspect. So, likewise, a chronic disease of the skin occasionally relieves a pre-existent disease of the mucous membrane; whilst in other cases it re-acts on and aggravates it.

Now such various and even opposite effects are equally produced from a new or *counter*-irritation artificially established in the system; and it is, therefore, obvious that, unless judiciously administered, this remedy may prove prejudicial instead of salutary. Experience continually proves that, under certain conditions of the system, a blister or other counter-irritant aggravates the inflammation which it was applied to remove. If we inquire what these conditions are, we shall find them chiefly to consist of an excited or irritable state of the general circulation, and a susceptibility or excessive sensibility of the nervous system. We shall find, however, that the remedies employed as counter-irritants have other effects which in a considerable degree modify this qualification of their utility.

Having thus in principle limited ourselves in the expectation of advantages from counter-irritation, we may proceed to consider its effects and uses in the various forms in which practice has employed it.

Counter-irritation may with advantage be considered in relation to its degree, and to the different tissues or parts which it affects. We shall, therefore, notice successively the remedies called rubefacients; vesicants; pustular or empyematous counter-irritants; setons, issues, perpetual blisters; and cauterizing counter-irritants.

Rubefacients.—In the slightest degree, counter-irritation consists in an erythematic excitement of the capillaries of the skin, terminating in complete resolution, sometimes with desquamation of the cuticle. An application exciting this degree of counter-irritation is called *rubefacient*. Moderate degrees of heat, (between 100° and 150°,) whether dry or with moisture, essential oils and spirits, æther, mustard, pepper, the strong alkalies and acids diluted, or weak acids in a concentrated form, and the strong counter-irritants applied for a short time or diluted, act as rubefacients on the skin, and are severally used with a view to this degree of counter-irritation. Being unaccompanied by any evacuation except an increase of the imperceptible perspiration, the action of rubefacients illustrates, better than epispastics of the severer kind, the principle of counter-irritation; and the instances of their utility are neither slight nor rare. A flask of hot water or a bag of hot sand; a poultice formed of bread-crumbs or linseed-meal and hot vinegar, with various proportions of mustard or pepper; an ammoniacal liniment or an essential oil applied by friction; pieces of cotton or flannel wetted with æther or camphorated spirit, and laid on the skin, evaporation being prevented by covering them with the warm hand, are rubefacient remedies which are often successful in removing slight internal inflammations, and in moderating those which are more intense. An incipient sore-throat is often cured by an ammoniacal liniment applied to the anterior part of the neck; a slight bronchial or a rheumatic inflammation by the same, or by the application of cajeput or other essential oil on the chest or part affected; a gastritic affection, marked by nausea, pain, and irritability of the stomach, and particularly when resulting from a powerful dose of medicine, is frequently relieved by a sinapism, or even a hot flask to the epigastrium; and a rubefacient property is joined to the derivative of a pediluvium, when, with the addition of mustard, pepper, or the strong acids, it is used to relieve the brain in fever with sleeplessness or low delirium. Some chronic inflammations of the slighter kind have likewise their more permanent rubefacient remedies. Thus a galbanum or a pitch plaster, occasionally rendered more irritating by the addition of a little cantharides, is of no small utility in chronic coughs and rheumatism. The old composition of soap plaster and muriate of ammonia, so useful for the knees of house-maids, is another example; but we may find one still more familiar in the effect of new flannel worn next the skin, which unquestionably owes some of its salutary influence to its rubefacient property. To these instances of rubefacients we may add friction and electric sparks, both of which are essentially rubefacients: the latter often produce a papular eruption; and the magnetic plates which have been recommended by some French physicians are asserted by Laennec to have a similar effect. These means, however, will be noticed under their respective heads.

Rubefacients, especially when extensively employed, are general as well as local stimulants; and although their local effect is such as to counterbalance their general effect in cases of low febrile excitement, they cannot be admitted where a generally phlogistic diathesis prevails; whilst in intense inflammations they must give place to the stronger kinds of counter-irritants.

Besides the examples of slight inflammation which we have adduced as fit cases for rubefacient applications, there are others of a mixed kind in which they are not less successful.

Spasmodic affections, particularly those attacking the stomach and bowels, various pains and aches, such as tooth-ach, ear-ach, &c., which seem to partake of a nervous as well as of an inflammatory character, are often more immediately relieved by hot flasks of fomentations, a mustard poultice or pepper plaster, than by any other remedy. These affections probably have more to do with congestion, or unequal distribution of the blood, than is generally supposed; and to this circumstance we are inclined to ascribe much of the efficacy of these applications: but it may also depend on the physiological law, that if the sensibility of a part is increased, that of the adjoining parts is diminished. In great depression of the vital powers, as in typhus fever, asphyxia, &c., the general stimulus of sinapisms, stimulant frictions, and the like, is advantageous; but we shall speak of this under the head of blistering counter-irritants.

The most active kind of rubefacient counter-irritants are *sinapisms* or mustard poultices; and their action is so speedy and energetic, that they are the most eligible remedies where a sudden local irritant is required. They are usually composed of flour of mustard and bread-crumb in equal or in various proportions, moistened to the consistence of a poultice with hot vinegar. MM. Trousseau and Blanc, in the Archives de Médecine (Septembre, 1830,) have detailed some curious experiments on the composition of sinapisms. They found that vinegar very much impaired the stimulant properties of the brown mustard commonly used in France, which contains the husk as well as the flour of the seeds, and they therefore recommended that sinapisms be made with water. The English mustard powder, however, which is the yellow farina separated entirely from the cortical part of the seed, is equally efficacious when mixed with vinegar and with water. Sinapisms made from mustard recently ground act more promptly than those from mustard which has been for some time kept. MM. Trousseau and Blanc tried the admixture of alcohol with sinapisms, but found it inferior to either vinegar or water. Dr. Paris recommends the mixture of oil of turpentine to quicken the operation of sinapisms; its efficacy depending on its extracting the essential oil, in which the stimulant quality of the seeds resides. Sinapisms produce, in the course of a few minutes after application, a sense of heat, which increases to a smarting and burning pain of almost intolerable intensity. After a while this subsides, and is succeeded by a feeling of weight and fulness, with active throbbing of the arteries. In the course of twenty or thirty minutes the burning pain again returns, and unless the patient be insensible from some cerebral affection, he can never bear the application of a sinapism beyond three quarters of an hour. The effects on the skin are remarkable. Applied for a few minutes, a sinapism does not produce a redness in proportion to the pain; but a short time after its removal the part becomes of a scarlet colour. When left on for ten minutes and upwards, the skin becomes of a deep crimson or purple colour, which remains long after all sensation has ceased. Vesication is sometimes irregularly produced after forty or fifty minutes' application, but it is imperfect, and greatly disproportioned to the degree of inflammation. The intensity of the inflammation is such that there is considerable risk of gangrene supervening, if the sinapism remain applied for more than an hour. As long as sensation is preserved, the excessive pain would be a security against its being too long applied; but in cases of stupor and insensibility it should not, therefore, be permitted to remain beyond an hour. The pain excited by sinapisms may be allayed by cold applications, or, according to MM. Trousseau and Blanc, by cataplasms of hyoscyamus, belladonna, and stramonium leaves, or by ointments containing extracts of these plants. Sinapisms are classed here because their rubefacient is their most salutary property; vesication and gangrene being their occasional or accidental rather than their desired effects. In the inflammation of organs which sometimes comes on in the progress of fever, in nervous and spasmodic disorders, and in inflammations dangerous rather from their seat than from their extent, they are remedies of the greatest value.

Vesicants.—The next degree of counter-irritation which we shall notice is that in which the excited capillaries throw out a serous fluid, which detaches the cuticle from the cutis, and raises it in blisters. The more powerful of those agents which we have noticed as rubefacients, if kept applied for a sufficient length of time, produce this effect; but their vesicant is not always in proportion to their rubefacient property; and others which are more certainly and exactly vesicants, are more generally preferred. Several vegetable juices produce an eruption of small blisters; as that of some kinds of ranunculus, clematis, &c. But the Spanish blistering-fly, the *cantharis*, or *meloë vesicatoria*, is the remedy which best answers as a vesicant, and is the one almost solely employed. The active property, according to the researches of Robiquet, appears to reside in a peculiar principle soluble in æther and in oil, to which is applied the name of *cantharidin*. The form, therefore, in which it is most successfully applied is in a compound of the powdered flies with hog's lard, or some such oleaginous substance, and a due proportion of wax or resin to give it the consistence of soft plaster. This spread on leather, or any other convenient substance, and applied to the skin, soon produces a sense of heat and pricking in the part, attended, if the application is large, with some excitement of the circulation and quickness of the pulse. If it be removed in two or three hours, its effect is merely rubefacient, and no blistering is produced; but if it be allowed to remain for a space varying in different individuals from five to ten hours, the skin will be found raised in large blisters filled with a yellowish serum, which continue to rise after the blister has been removed. In some cases they do not appear until after it has been dressed; and it is, therefore, unnecessary to keep the plaster on until they are formed, or till, as it is commonly expressed, the blister rises. When the blisters are fully risen, they are snipped with a pair of scissors, which allows the serum to escape; and if it be intended that the part should heal, it is dressed with simple ointment spread on a linen rag. The serosity continues to escape, and sometimes to raise fresh blisters, for some hours after; these must be treated as before, and the dressing renewed twice in twenty-four hours.

The discharge of serum produced by blisters renders them evacuants as well as counter-irritants; and this property must be taken into account in judging of their remedial powers. Until the vesication is complete, they have all those general stimulating effects which we have noticed as belonging to counter-irritants in general. But the serous effusion greatly modifies this, insomuch that after a blister is dressed, it is common to find the pulse weaker than before its application. The first excitement of a blister often communicates itself to the mental faculties; its discharge commonly causes a general depression, with a disposition to sleep. These different effects are much more marked in some individuals than in others, and are necessarily modified by the existing disease. But cantharides have properties of a peculiar kind, which not unfrequently exert an influence on the general operation of blisters. When their active principle is absorbed into the system, it proves very irritating, and in a peculiar manner affects the urinary organs, causing strangury and even bloody urine. To obviate this, it is commonly recommended to persons during the operation of a blister to drink copiously of diluent mucilaginous liquids; but we cannot refrain from expressing our conviction that this practice defeats much of the good effect of the blister. In many inflammations, particularly in those of the thoracic cavity, a chief object of blisters is to restrain the effusion of serum internally, or to promote its absorption; and this they do by extracting serum from the mass of blood in the adjoining vessels. But if liquids are thrown in such quantities into the stomach, they are rapidly absorbed into the circulating fluids, counterbalance the effect of blisters as local evacuants, and reduce them to simple counter-irritants. In such inflammations we are convinced by experience of the advantages of abstinence from any bulk of liquid, and would, therefore, look for other means to avoid the irritating effects of absorption from a blister. This may pretty effectually be obtained by interposing between the skin and the blistering plaster a piece of thin gauze or muslin, moistened with oil, which being a menstruum of the blistering principle, transfers its effects to the skin, whilst the gauze or muslin prevents the particles of fly from adhering to the skin, after the separation of the cuticle has rendered it an actively absorbing surface. By taking care, also, not to allow the blister to remain on longer than is necessary, we may generally avoid these unpleasant consequences: six hours is generally sufficient; for whether the blister may have risen or not, if the skin at this time appear very red and inflamed, the vesication will almost uniformly take place after its removal. It has been asserted that by boiling the cantharides their peculiar effect on the kidneys is prevented, while their blistering power is unimpaired: of this we cannot speak from experience.

Before concluding our remarks on the remedial powers of blisters, we shall add a few cautions for their management. The due contact of the blister with the skin is of importance; and this may be effected either by a bandage or by a few strips of adhesive plaster: but if too great a pressure be exercised, it will restrain the inflammation of the capillary vessels, and no vesication will ensue. It is not adviseable to apply a blister to an excoriated surface, as the absorption of the acrid matter and its unpleasant consequences are very apt to ensue. When, from peculiar idiosyncrasy, blisters produce great irritation, local or general, the addition of a little powdered opium or acetate of morphia to the plaster may give relief. An excess of inflammation, which occasionally ensues after the rising of a blister, sometimes with erysipelatous or eczematous appearances around it, is best relieved by poultices, which are proper applications whenever it is desirable to moderate the irritation. When the blistered part shows a disposition to gangrene, which is not unfrequently the case with children, it must be treated on general principles, as by stimulating or other applications, solutions of chloride of lime or soda, and bark exhibited internally. To avoid this consequence in children, it is adviseable never to allow the blister to remain on more than six hours; and a poultice should be substituted if the inflammation be at all high.

Simple blisters, or, as the French term them, *vesicatoires volans*, (in contradistinction to those which are kept discharging by an after application,) are remedies much and deservedly esteemed in the cure of inflammations. As rubefacients, or simple counter-irritants, they yield to sinapisms and other remedies which we shall presently notice; but their effect as local *depletories* gives them a superiority over most other counter-irritants. In common with the other remedies of this class, they are unfit for the first stages of extensive acute inflammation; but when the general excitement of the circulation, and the intensity of the orgasm, have been so lowered by bloodletting and other means, that the temporary irritation of the blister may be borne without risk, its action becomes highly salutary; in the first instance drawing off the irritability from the diseased part, and then removing or exhausting it by an effusion of serum. This effusion proves the means of so *deriving* to the blistered part, that the morbid exhalations in other parts are re-absorbed and drained off; and hence blisters, more than rubefacients, are adapted to inflammations of serous membranes. Besides the caution required not to apply blisters at too early a stage, it is generally necessary to beware of placing them too near the seat of inflammation; for their contiguity may greatly aggravate it, causing two inflammations, as it were, to run into one. This must be left to the discretion of the practitioner; but it may be suggested that in inflammations of the pleura, — in those superficially affecting the pulmonary substance, as indicated by auscultation, — in those attacking the membranes of the brain or the larynx, it is better to place the blister on some part adjoining rather than immediately over the affected part; and to make up by extent of the surface blistered, for any diminution of effect from distance. In fact, in all acute inflammations large blisters are to be preferred to small ones; for the irritation from the latter is nearly as great, without the same good effects. In chronic inflammations the case may be somewhat different, as it is usually necessary to apply a succession of blisters; and the weakening effects of a large discharging surface might make small ones preferable. Of chronic inflammations, those affecting the serous and mucous membranes receive the most benefit from blisters. In pleuritic and peritoneal inflammations accompanied by effusions, their evacuant effects are likewise of decided utility; and with this view they should be of large size. But in inflammation of the parenchyma of the viscera, and in that of membranes without much liquid effusion, the more powerful counter-irritants are of greater efficacy.

We have already noticed that rubefacients are sometimes valuable in continued fever, on account of the stimulus which they convey to the vital powers; and we may extend this observation to blisters, which, judiciously administered, are often doubly useful, both by the general excitement which they afford, and by their local counter-irritation and evacuation relieving the several internal organs, which almost constantly suffer in these fevers. But, equally as in the case of acute inflammations, during the stage of synocha or morbid excitement they must be excluded as injurious. It requires much nice discernment to decide on the time at which blisters may with advantage be used. Dr. Rush considered that there is a period in all fevers at which they would prove salutary; but we shall not attempt here specifically to define it. (See Fever.) By counter-irritants or revulsives of the most prompt and powerful kind, as boiling water, some signal cures have been effected in the worst forms of fever; the patient having been by them at once awakened to consciousness from coma or extreme collapse. M. Marjolin cites his own case as an example of this treatment; and Dr. Macintosh records one which occurred in his practice eight or ten years ago: and we have heard of other instances of its success. As there is a great risk in the subsequent effects of the local injury, which generally tends to gangrene, this practice can only be resorted to in extreme cases.

What has been said of rubefacients in spasmodic and convulsive disorders may be equally applied to blisters, which are in fact the form generally resorted to, although full blistering is probably inferior to sinapisms repeatedly applied for a short time. There is likewise a state of general irritability of the system, accompanied with various and occasionally fugacious pains, but without hardness or fulness of the pulse, that is often greatly relieved by the application of a blister, which seems to localise the irritation, and thus relieve the system.

An exception is commonly taken to the use of blisters in the case of inflammation of the kidneys and other parts of the urinary apparatus, on account of the irritating effect of cantharides towards those organs through absorption; and although this may generally be prevented by attending to the precautions which we have before enumerated, it is acting safely to prefer some other counter-irritant. This leads us to say a few words on other vesicating remedies.

All those irritant agents which act in the most prompt and energetic manner, without destroying the cuticle, raise it at first into blisters filled with a serous fluid. Thus, boiling water, or its vapour, the concentrated alkalies, or metal heated in water, as recommended by Sir Anthony Carlisle, produce this effect. Intense heat, the strong acids and some metallic salts corrugating and destroying the cuticle, act more immediately as escharotics. But this mode of blistering is very unmanageable, as the inflammation accompanying it is of a diffuse and uncertain character, and often leads to severe sloughing. There is a method of applying the vapour of boiling water in a jet, by means of an eolipile, or vessel with a narrow orifice, which might be so regulated as to produce vesication without proceeding deeper; and the liquor ammoniæ triturated with an equal weight of hogs' lard may be applied, so as to produce full blistering in fifteen or twenty minutes; but unless great speed is desirable, these agents, even thus modified, are not eligible as mere vesicants.

Pustular or Empyematous Counter-Irritants.—We have hitherto referred to those degrees of artificial external inflammation which terminate in resolution or serous effusion. There is, however, an important class of counter-irritants, affecting the cutaneous texture more deeply, and determining the secretion of pus. A blistered surface sometimes spontaneously takes on this degree of inflammation; and the same effect is frequently brought on by particular applications to it; but as these methods of counter-irritation are of a mixed kind, we shall presently return to them under the head of *issues* and *setons*, and here notice particularly those applications which bring on suppurative inflammation of the skin in the form of pustules. The sulphuric and nitric acids, their escharotic power being blunted by dilution with oil or lard, produce an inflammation, which soon assumes the form of pustules, small and distinct, or large and confluent, according to the proportion and strength of the acid used. But the substance most eminently calculated to excite the pustular inflammation is tartarized antimony. We owe the introduction of this medicine as a counter-irritant to the late Dr. Jenner, who employed it in the form of ointment, in the proportion of one part of the salt to five of spermaceti ointment. It has since been extensively employed in practice, and is almost as generally used as a pustular irritant, as cantharides are to produce vesication. In our own hands we have found it so manageable as well as effectual a counter-irritant, that we consider it a remedy of equal importance with the blistering fly itself; but, as much of its efficacy depends on the method of its application, before describing its advantages we shall premise some precautions on this point.

Tartar emetic exerts no corrosive or solvent power on the cuticle; it therefore sometimes happens that considerable difficulty is experienced in making the cutis feel its effects, and this obstacle is of course greater where the cuticle is naturally dense or thick. To obviate this we recommend the part to be previously excited, either by friction with warm flannel or a flesh-brush, or by some stimulating application of a penetrating quality, such as camphorated spirit or strong vinegar, or a mustard poultice applied for a few minutes. When the vascularity and sensibility of the skin have been thus exalted, the tartar emetic ointment is to be rubbed in, and it will then take a more equal as well as more certain effect: instead of having a few large and unmanageable sores produced in two or three days, as is often the case in the usual method, a vivid erythema immediately succeeds, which in the course of a few hours breaks out into a thick crop of pustules, the size and course of which vary according to the strength of the ointment and the duration of its application. On these points it is not easy to lay down any absolute rule; for, as in the operation of blisters, much depends on the individual constitution. We generally prefer an ointment of considerable strength, for instance, made with one part of tartar emetic and two of simple ointment. If the fullest effect be desired, the friction, both preparatory and with the ointment, should each be persisted in for fifteen or twenty minutes. This generally leads to the speedy formation of confluent pustules, which go on to maturation. To diminish this effect it is best to shorten the period of friction with the ointment; and where we wish for the slightest degree of counter-irritation, it is generally sufficient to *smear* the ointment on the part previously excited by dry friction, or by some of the other applications before enumerated.

Another mode of counter-irritation by tartar emetic is, the employment of a saturated aqueous solution: the elegance and convenience of this form render it peculiarly eligible where the ointment might be considered disgusting. It is expedient to make the solution as warm as the skin can bear it, as the heat both enables the water to dissolve more of the salt, and quickens the effect on the skin. The part being previously excited as for the ointment, the solution is to be gently rubbed on it by means of a piece of flannel, and continued for a longer or shorter time, according to the degree of effect desired. The pustules thus excited are usually small and numerous, and unless the application have been continued for some time or repeated, they dry up and heal speedily. As this application leaves no marks or seams, it is particularly suited to females, who generally renounce all medicaments which may leave a trace behind. Plasters sprinkled with tartar emetic in powder have been greatly recommended; but we have found their operation very uncertain; in some cases inefficient, and in others causing a frightfully ulcerated surface, which the removal of the plaster necessarily exposes. After the application of the tartar emetic, whether in ointment or in solution, the part should be covered with a piece of rough flannel, which, if it be desired, may be made still further to promote the effect by a little ointment smeared on it. By this system of management tartar emetic may be made to produce any degree of counter-irritation, from a papular or erythematous blush to an extensively suppurating sore.

Pustular or suppurating inflammation thus excited is generally more permanent and profound in its counter-irritant influence than vesication. The formation of pus requires a greater development of vital action, a higher degree of local irritation than serous effusion, without proving more stimulant to the system. For this reason we consider the tartar emetic counter-irritant better adapted than blisters to remove deep-seated parenchymatous inflammation, even of the acute kind; and although it must not supersede the free previous use of depletory measures, yet it may be employed with less hesitation than blisters, inasmuch as the absorption of the medicine into the system proves antiphlogistic instead of irritating. That such an absorption does take place is probable from the nausea which sometimes attends the use of the medicine; and we have known in a few instances violent vomiting ensue.

In the method which we have recommended for its application, counter-irritation with tartar emetic may be brought to its greatest effect of copious suppuration in from ten to twenty hours, and a full pustular eruption may be brought out in five. This rapidity of effect places it on a par with blisters; and the greater intensity of its inflammation renders it a better counter-irritant. It is perhaps inferior to them in pleurisy, meningitis, and those inflammations in which the principal danger arises from serous effusion. In gastritis, likewise, its tendency to excite vomiting may render it objectionable. In most other acute inflammations, if its proper application be attended to, we prefer it to blisters, and in none has it proved more beneficial than in those of the lungs and air-passages.

In chronic inflammation the efficacy of tartar emetic counter-irritation is more generally acknowledged. We have found it far more beneficial than either blisters or setons in chronic bronchitis and pertussis; and if we can venture no further, we may unhesitatingly assert that we have seen it retard the progress of tubercular consumption. An eruption excited and renewed on the chest, sometimes on one side, sometimes on the other, seems in these cases to act as a safety-valve to the system, letting off any incipient disposition to inflammation; and thus, without much impairing the strength, enables the body to bear tonics, and a more generous diet than it would otherwise support. It has been found of signal utility in diseases of the joints and of the bones, and is preferred by some surgeons to moxa.

Numerous cases of epilepsy, chorea, and other convulsive diseases, also cases of mania, paralysis, and neuralgia, have been recorded, in which tartar emetic counter-irritation on the nape of the neck, along the spine, or the course of a nerve, has produced relief, and even a cure. But as in these disorders the scientific physician must see pathological causes of very various nature, it would be irrational to assert that the remedy in question is universally applicable to them. As often as they arise from, or are aggravated by, some local inflammation, irritation, or congestion, we can at once perceive its utility; but we can never be reasonably confident in our expectations of success when we remember how often there are immediate organic causes for these diseases. In these and other complaints, nature not unfrequently throws out a hint in the form of a spontaneous eruption; and the physician may with great advantage be instructed by it, and second her efforts by means of this remedy. From the facility with which this counter-irritation may be excited and kept up for any length of time by a slight fresh application, it is well adapted to remove or prevent inflammations of the eyes, ears, and fauces, which sometimes engraft themselves on the habit, and are very difficult to remove.

A remarkable effect has been observed to ensue in a few cases from the use of tartar emetic ointment; namely, an irritation, sometimes very severe, of the genital organs. We have never seen this except in cases where the ointment had been used for several days in succession, which is rarely necessary according to the method which we have recommended for its use.

When the inflammation excited by tartar emetic runs too high, it may, as in the case of blisters, be moderated by a warm bread poultice, which does not interfere with the progress of the pustules.

Perpetual blisters, issues, and setons.—We have delayed to notice these counter-irritants, because they are of a mixed nature, and occasionally partake of the qualities of all those which we have already described. The inflammation which they excite is of very various degrees of intensity, and the discharge which they occasion is sometimes purulent and sometimes serous.

Blisters are kept open by removing the raised cuticle by scissors, and by applying, instead of the ordinary dressing, an ointment or cerate of an irritating quality. A small portion of cantharides is sometimes used for this purpose, but the bad effects of its absorption, which frequently ensues, raise a great objection to it. A cerate containing euphorbium and the unguentum resinosum has likewise been employed with the same view. But the ceratum sabinæ is that most commonly resorted to; and, if duly managed, it is capable of maintaining a more equal degree of irritation and discharge than any other. It is, however, necessary to attend to the strength of the cerate applied; and if discharge be the principal object, it ought to be applied in a diluted form. Blisters kept open in this way, without profoundly affecting the skin, sometimes yield a copious secretion of pus, and then prove most salutary. With a continuance of the same application, however, this very commonly becomes thinner and again serous; and in time the part is habituated to the irritation, dries up, and heals. To prevent this, it is necessary to remove the films of coagulable lymph which form upon it; to keep down vegetations by touching them with nitrate of silver or burnt alum; and occasionally to cleanse the surface by an emollient poultice, or by warm fomentations with flannel. By changing the stimulating ointment, the irritation and discharge may be preserved much longer than when one only is employed. On the whole, however, this method of counter-irritation is troublesome and uncertain, and may well be superseded by a succession of blisters, or by tartar emetic.

By *issues* and *setons* irritation is applied more profoundly, being brought immediately into the subcutaneous tissue itself. The former are made by producing an opening in the skin, either by incision, by a blister, or the application of some escharotic substance, such as potassa fusa, nitrate of silver, muriate of antimony, &c., and introducing some foreign body, as a pea or a glass bead, into it, which keeps up the irritation, and forms a constant ulcer. In producing the ulcer by means of caustics, it is necessary to limit the operation, and defend the adjacent parts by a piece of adhesive plaster, with an aperture in it of the required size of the ulcer. A bit of potassa fusa placed in this aperture in the course of four or five hours forms an eschar, surrounded by an areola of inflammation. This eschar being dressed with citrine, or other stimulating ointment, begins to detach itself and to secrete pus in the course of four or five days, and after that falls off, leaving an ulcer more or less profound.

Setons are made by passing a lancet-bladed needle, with a fasciculus of thread or silk attached to it, through a portion of the integuments (pinched up between the finger and thumb), so that the threads are left in, with the ends hanging out at each orifice. To increase the irritation, the thread is anointed daily with the unguentum resinosum, and shifted or renewed to keep the wounds open or discharging. The necessity for the renewal is superseded by substituting a long strip of caoutchouc or of lead for the threads. The inflammation at first excited by setons is sometimes so intense as to require the application of poultices to moderate it; and their dressing and management require many precautions which it is the province of surgery to teach.

Issues and setons, when in full operation, excite a phlegmonous inflammation, attended by a discharge of an abundant thick pus. This is most frequently the case with setons, and with issues formed by caustics; and these are, therefore, the most powerful and profoundly acting of their kind. But like perpetual blisters, they are apt, with the same material of irritation, to become indolent and callous, and the secretion serous and less abundant. When energetic, these remedies are of great utility in chronic inflammations of various kinds. If any distinction can be made as to the kinds in which they are most serviceable, it may be suggested that the circumscribed textural inflammation of viscera are peculiarly benefited by their use. When in a more moderate form, and secreting serum, they act rather as evacuants, and have been, not unaptly, compared to a new secreting gland in the system. They thus occasionally prove safeguards against apoplexy, palsy, and other diseases of repletion; although implicit reliance ought not to be placed on such means. For the same reason they are proper adjuncts in the cure of long-continued cutaneous disorders, preventing any ill effects from the suppression of the natural counter-irritation. So, likewise, in all cases where setons or issues themselves have been for some time used, it is proper to be cautious in suppressing them, by doing it as gradually as possible, and carefully ensuring the free action of the bowels and other secretory organs. As a means of restraining the growth or diminishing the size of tumours and bronchoceles, setons have been found of some use; and the drains which they afford have likewise checked the increase of dropsical effusions.

[There are other agents, which, according to their mode of application, are capable of inducing more than one of the effects already mentioned. When *croton oil*, for example, is rubbed in small quantity, and for a short time, on the surface, it induces inflammation of the skin, which gradually disappears of itself. When the friction is longer continued, pustules are caused, which, when they are numerous, run together or are confluent; and, around the spot where the confluent eruption is seated, papulæ appear over a wider extent, which are transformed into pustules, and are surrounded by a red base or areola. Commonly, the eruption is perceptible in twelve hours after the first friction; but at times not until a later period. In the course of from three to six days, the eruption again disappears. The eruption is never so painful as that induced by the ointment of tartrate of antimony and potassa.

Frictions with croton oil are adapted for all cases in which local counter-irritation is required. It is important, however, to bear in mind, that the oil may be absorbed, and act on the bowels, and may not, therefore, be adapted for intestinal disorders, in which counter-irritation is indicated. If the skin be thick, and insensible, it may be well to rub it previously with flannel, or to apply first a rubefacient, especially when it is desirable to produce the effect speedily. On the other hand, when the skin is excitable, the croton oil should be mixed with from one to four or five parts or more of olive oil, oil of turpentine, or soap liniment. (See the writer's *General Therap. and Mat. Med.* ii. 265: Philad. 1843.)

The *essential oil of mustard* is occasionally used wherever a counter-irritant is needed. It is used either in the form of friction, or where a more powerful effect is needed, by dipping strips of linen, of the proper size, in the oil, and suffering them to dry on the part. Burning pain immediately succeeds, and is often so insupportable, that the patient objects to wait until the linen is dry. (*New Remedies*, 4th edit. p. 463: Philad. 1843.)

Ammonia has been employed to excite rubefaction and vesication. The *pommade ammoniacale* of Gondret has long been used in chronic affections of the brain, incipient cataract, amaurosis, &c., being applied to the top of the head. (Gondret, *Considerations sur l'Emploi du Feu en Médecine*, &c.: Paris, 1819; and *Traité Theorique et Pratique de la Derivation*, &c.: Paris, 1839.) The formulæ for summer and for winter, recommended by M. Trousseau, (*Journ. des Connais, Med. Chir.* cited in *Medico-Chirurg. Rev.:* July, 1840) are as follows: for summer, three parts of *lard*, one of *suet*, and four of *liquor ammoniæ;* for winter, equal parts of *lard* and *liquor ammoniæ.* More recently, a stronger and a weaker *ammoniated lotion* have been extolled extravagantly as counter-irritants by Dr. Granville. (*Counter-Irritation*, &c., Lond. 1838, or Amer. Med. Library edit.: Philad. 1838.) The milder of these is made as follows: *Liq. ammon. fort.* f.℥i.: *Spirit roemarin.* f.ʒvi.; *Tinct. camphor.* f.ʒii. M.; the stronger as follows: *Liq. ammon. fort.* f.ʒx.; *Sp. roemarin.* f.℥ss.; *Tinct. camph.* f.ʒii. M. Raspail (*L'Expérience*, 24 Juillet, 1840) has recommended the following lotion, the effects of which, he says, are often instantaneous in relieving intolerable headach: *Liq. ammon.* p. 100; *Aquæ destillat.* p. 900; *Sodii chlorid. purif.* p. 20; *Camphor.* p. 2; *Essent. ros.* q. s. The whole to be mixed cold. A piece of linen is to be steeped in this solution, and applied over the part of the head which is the seat of pain, care being taken that none of the fluid passes into the eyes.

The stronger of Granville's lotions gives rise, in a few minutes, to vesication over the whole surface to which it is applied, almost as rapidly, indeed, as if boiling water were placed upon the part. The strength can be regulated so as to produce either full vesication or simple rubefaction, by varying the quantity of the liquor ammoniæ. As a general rule, the application should be seldom continued longer than from one to six or eight minutes. But, in order to excite the higher degrees of counter-irritation, as vesication and cauterization, as much as ten or twelve minutes may be necessary.

The mode of applying these liquid counter-irritants is first to impregnate with them a piece of cotton or linen, folded six or seven times; or a piece of thick or coarse flannel; and then lay either of these on the spot, pressing with the hand, at the same time, very steadily and firmly on the compress, over which there should be placed a thick towel doubled several times, so that not only the evaporation of the lotion may be impeded, but the hand employed in pressing the compress on the part, may not suffer from direct or indirect contact with the liquid. Care must be taken that the ammonia does not reach the eyes or nose. (Granville, *op. cit.* Amer edit. p. 89.)

There can be no doubt that the ammoniated counter-irritants are valuable agents in all diseases that are benefited by a sudden and powerful revulsion, and especially in different forms of neuralgia. One great objection to them is, that they are apt to induce sloughing and sores difficult to heal. Care may prevent these; but at times they occur in spite of every precaution. (*New Remedies*, p. 197.)]

Cauterizing Counter-Irritants.—By this term we designate all those operations in which heat, in such degree as to cause disorganization of the part, is applied as a counter-irritant. The common effect of all these is the formation of an eschar, or dead slough, surrounded by a more or less intense inflammation, which causes the separation of the dead part and the production of an ulcerous cavity in its place. The local inflammation, thus excited, may be very intense, and the suppurative discharge very perfect; and this kind of counter-irritation is proportionately energetic in its effects on the disease, in the same manner as others. But there seems to be another peculiar result from the application of vehement heat: namely, a strong impression, or shock, on the nervous system, which in certain diseases is not without its salutary influence.

Heat, with a view to cauterization, is applied by heated metallic instruments, burning substances, boiling water or its vapour. Instruments of iron or copper, heated to different degrees of incandescence, are sometimes used to produce local irritation and sores. This operation, which is called the *actual cautery*, produces, more than any other method, that shock to the nervous system to which we have just alluded. It has been found useful in checking violent convulsive diseases, such as epilepsy, hysteria, and local spasms. It is difficult to judge whether its efficacy depends on the pain, or on some other change wrought in the nervous system; the effect is certainly sometimes produced before such a degree of local inflammation has been excited as could act by vascular counter-irritation.

A red-hot iron is sometimes used to form issues; and for this purpose it is applied with considerable pressure to the part for eight or ten seconds, and repeated if it is wished to make the ulcer deep. A portion of skin and of the cellular texture underneath is thus killed, and forms an eschar, which in the course of six or eight days is sloughed off, and the ulcer produced may be treated as an issue. The painful and formidable nature of this operation excludes it from general adoption; and, with the exception of the cases just alluded to, we do not know that it can claim any superiority over that with caustic, which is attended with little pain. The good effects of the actual cautery are, perhaps, obtained with least attendant inconvenience when the metal is heated to a white heat. Thus applied, it immediately destroys the vitality and sensibility of the part; and if the surrounding skin is protected by coverings of wetted paper or other suitable substance, in the way which has been recommended by Dr. A. T. Thomson, the suffering of the patient is much diminished, and the advantages of the remedy are with more certainty procured. The actual cautery is more frequently resorted to in surgery for the destruction of malignant productions and morbific poisons.

There is a method of cauterization, called by surgeons *transcurrent*, which partakes more than the preceding of the nature of a counter-irritant. It consists in lightly passing an iron, heated to a cherry red, on the surface of the skin in parallel lines, at such a distance from each other that an intervening space may be left free from inflammation. In this way long narrow eschars are formed, which in the course of eight or ten days are enlarged; whilst the whole surface becomes highly inflamed, and is not relieved from the painful and phlogosed state of a common burn until a copious suppuration ensues, which often lasts for a fortnight or more. The fever and irritation which this process occasions forbid its employment in any but very chronic and indolent cases. It has proved very successful in removing chronic enlargements of the joints, and the remains of rheumatic affections.

Cauterization by substances in the state of combustion has of late years been practised to a considerable extent in the form of what is termed *moxa*. This method is said to have been adopted from Japan, where moxas are made of a down obtained from the leaves and tops of a species of *artemisia*, made into a cone, which when lighted burns spontaneously. The pith of the stalk of the sun-flower and of other *helianthi* likewise possess this property, which is owing to a small quantity of nitre in their composition. The material generally employed in Europe for moxas is cotton, rendered downy by carding, and made into a roll an inch long, and from half an inch to two inches in diameter. This is held by a forceps or wire, with one end in close contact with the skin, whilst the other is set on fire; the adjoining parts being protected by wet pasteboard or linen. The combustion is supported either by blowing or fanning, or by a slight impregnation of nitre previously given to the cotton. The sensation produced by the burning of a moxa is first that of warmth, rather agreeable than otherwise; this soon increases, as the fire approaches the surface, becomes itching, then more and more painful, and attains its acme of intensely sharp scalding pain when the combustion reaches the skin, which smokes and becomes crisp under it. The neighbouring skin is vividly inflamed, puckered, and sometimes slightly blistered. The eschar thus formed is deep, and requires a fortnight or upwards before it is separated. The ulcer formed discharges pus abundantly, and by the aid of a pea may be converted into an issue.

The gradual manner in which heat is communicated to the part in the burning of a moxa causes it to penetrate more deeply than any other form of actual cautery. Hence as a remedial agent it is well adapted to make an impression on deep-seated inflammation; and in diseases of the spine and its contents, in scrofulous and rheumatic swellings of the joints, in chronic diseases of the liver, kidneys, and other internal organs, in paralysis and neuralgia, it sometimes proves more effectual than any other remedy. It is often necessary, however, to employ several moxas in succession; and if the disease be of some extent, several simultaneously, before the good effects become apparent. Moxas may be applied with greatest advantage as near as possible to the diseased part; but if their effect is intended to be deep, it would not be proper to apply them on parts where cartilage, tendon, or bone are close under the surface.

Moxas are sometimes applied with a view to counter-irritate without producing an eschar. The moxas in this case are made of sun-flower pith, or of light cotton impregnated with nitre. The combustion is effected without blowing, and is not suffered to reach the skin. Under this form, frequently applied, they have been found useful in promoting the absorption of indolent effusions in joints and cold tumours. It is probable that much of their effect in these cases depends on the stimulus which they impart to the organic sensibility of the diseased tissues which cannot be included in their counter-irritation.

[Various forms of moxa have been proposed. Mr. Leney (*London Medical Gazette*, July 15, 1842) soaks a piece of lint in a strong solution of nitrate of potassa, dries it, and cuts off pieces of the size of the thumb-nail, which he fastens, with thin adhesive plaster, over the seat of pain; sets fire to the opposite extremity, and then applies the blow-pipe. The pain during the process is very severe; but the Irish, he affirms, prefer it greatly to the application of a blister. Professor Gräfe (*La Lancette Française*, Jan. 26, 1839) employs moxas made of wafers, dipped in a mixture of three parts of oil of turpentine and one part of sulphuric ether. Before applying this inflammable matter to the skin, it is necessary to remove carefully the superfluous liquid. These moxas are said to ignite readily, burn promptly and uniformly, and do not crepitate.

Of late, a plan for exciting vesication on the surface has been adopted, which must be regarded as a kind of moxa. It produces rapid vesication, but is said to be complicated, and attended with intense pain, (Granville, *op. cit.* Amer. edit. p. 21 and p. 42.) A piece of linen or paper, cut of the requisite size, is immersed in spirits of wine, or brandy. It is then laid on the part to be blistered; care being taken that the moisture from the paper or linen does not wet the surrounding surface. The flame of a lighted taper is applied quickly over the surface, so as to produce a general ignition, which is exceedingly rapid. At the conclusion of this operation, the cuticle is found detached from the true skin beneath. In cases of convulsions, the region of the spine has been treated in this manner, and with good effect. (C. J. Edwards, *Provincial Med. and Surg. Journ.* Jan. 1842. See, also, the writer's *New Remedies, edit. cit.* p. 441.)]

A cauterizing effect may be produced by boiling water, or better by its vapour. The best method of effecting this is by an *eolipile*, or vessel with a narrow tubular mouth, and kept boiling by means of a lamp. The jet of vapour issuing in full force from this is directed against the part, which is covered with thick pasteboard or linen, with an aperture of the form and size of the part intended to be cauterized. The pain caused by this operation is very severe, and the slough formed very deep. It most resembles moxa in its effects; but the wound produced by it is less manageable, and more apt to involve the surrounding parts.

C. J. B. WILLIAMS.

CRISIS, CRITICAL DAYS. (See DISEASE.)

CROUP.—(*Synonyms*—Cynanche *trachealis*, C. *laryngea*, C. *stridula*, Angina *polyposa*, Suffocatio stridula, Morbus strangulatorius, &c.) We prefer croup to the other appellations, inasmuch as it does not convey an erroneous notion of the nature of the disease which it designates: that disease is not a mere cynanche, or quinsy. It will be shown that inflammation, which is the characteristic of the order of diseases to which croup belongs, is not confined to the throat, but generally extends through the ramifications of the bronchi; therefore, C. *trachealis* and C. *stridula* ought no longer to be retained as nosological terms. The terms suffocatio stridula and morbus strangulatorius are indefinite, and would equally apply to the various affections in which those symptoms of croup—the *inspiratio strepens, vox rauca*, and *tussis clangosa*—are engrafted on other diseases, and which will be treated of under their respective titles.

This disease was honoured with the attention of the greatest man of the present age—if he can be called great who had no just sense of moral grandeur. In consequence of the general order which Napoleon issued from the head-quarters of Finkenstein,[*] many essays on croup were written by foreign physicians of ability, in which nothing is omitted in illustration of that disorder which industry could collect or method could arrange.

Occasional Causes.—In the early part of his professional life, the writer of this article lived on the coast of the Firth of Forth, where croup may be considered an endemic disease, and where every facility was afforded for cultivating an acquaintance with it. During the last twenty-two years, while practising medicine in Dublin, his opportunities of witnessing croup have not been unfavourable, especially when attending a dispensary. While discharging that duty, he had frequent occasion to observe the disease among the ragged and half-starved children of the poor who live near the canals which surround the city; or in Ringsend, near the estuary of the river Liffey; or in Sandymount, lying between Dublin and its bay: indeed the disease is prevalent, in the latter end of winter and in spring, along the whole of the eastern and northern coasts of Ireland. With respect to its prevalence along the rest of the sea-coast, no inquiries were made; his inquiries, however, sufficiently confirm the received opinion relative to the principal occasional cause of croup, viz. that in Ireland, as in Scotland, it is chiefly produced in the neighbourhood of large bodies of water, running or stagnant, fresh or salt.

History.—The disease may occur at any period from the second or third month after birth to puberty. The younger children are when weaned, the more liable are they to croup. After puberty it scarcely ever occurs. Some families, those especially in which the children are of a sanguineous temperament and full habit, are much more liable to the disease than others. It often attacks children who have not fully recovered from a previous illness. It is liable to recurrence, at distant intervals, upon exposure, not merely to an atmosphere which has been influenced by passing over a large body of water, but to any of the causes which produce common catarrh.

Hoarseness, in very young children, does not usually attend common catarrh; and hence when observed in a child living in a district which generates croup, this symptom is always much more deserving of attention, especially if accompanied with a rough cough, than it would be after puberty. This remark may be supposed scarcely worthy of the reader's attention; but having had innumerable opportunities of ascertaining that inflammatory affections of the mucous membrane of the larynx and bronchi in children owe their complexion to the mode of treatment adopted during the first six or eight hours of the attack, when no other symptom but hoarseness exists, we consider the observation important to parents whose children are liable to croup, and consequently to their family physician.

In the approach of an attack of croup, which almost always takes place in the evening, probably of a day during which the child has been exposed to the weather, and often after catarrhal symptoms have existed for several days, he may be observed to be excited, in variable spirits, more ready than usual to laugh or to cry, a little flushed, occasionally coughing; the sound of the cough being rough, like that which attends the catarrhal stage of the measles. More generally, however, the patient has been for some time in bed and asleep before the nature of the disease with which he is threatened is apparent; then, perhaps without awaking, he gives a very unusual cough, well known to any one who has witnessed an attack of the croup; it rings as if the child had coughed through a brazen trumpet; it is truly a tussis clangosa; it penetrates the walls and floor of the apartment, and startles the experienced mother—"Oh I am afraid our child is taking the croup:" she runs to the nursery, finds her child sleeping softly, and hopes she may be mistaken. But remaining to tend him, before long the ringing cough, a single cough, is repeated again and again: the patient is roused, and then a new symptom is remarked; the sound of his voice is changed; puling, and as if the throat were swelled, it corresponds with the cough: the cough is succeeded by a sonorous inspiration, not unlike the kink in pertussis—a crowing noise, not so shrill, but similar to the sound emitted by a chicken in the pip, (which in some parts of Scotland is called the roup, hence probably the word croup;) the breathing, hitherto inaudible and natural, now becomes audible, and a little slower than common, as if the breath were forced through a narrow tube; and this is more remarkable as the disease advances. A blush of inflammation may sometimes be detected on the fauces, and in some rare instances a slight degree of swelling round the larynx, and the child complains of uneasiness in his throat, and says he is choking. The ringing cough followed by crowing inspiration; the breathing, as if the air were drawn into the lungs by a piston; the flushed face; the tearful and bloodshot eye; quick, hard, and incompressible pulse; hot, dry skin; thirst, and high-coloured urine—form a combination of symptoms which indicate the complete establishment of the disease.

Sometimes the symptoms enumerated subside about midnight, even in the absence of medical treatment; perhaps to return in the course of the following evening. From seven or eight o'clock till midnight this complaint is always at its height;

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[*] Ce fut au quartier général de Finkenstein le 4 Juin, 1807, que S. M. I. et R. donna l'ordre d'ouvrir un concours sur la maladie connue sous le nom de croup; et c'est en exécution de cet ordre que son excellence Monseigneur le ministre de l'intérieur mit la question suivante au concours.

Déterminer, d'après les monumens pratiques de l'art, et d'après des observations, les caractères de la maladie connue sous le nom de croup, et la nature des altérations qui la constituent; les circonstances intérieures et extérieures qui en déterminent le développement; ses affinités avec d'autres maladies; en établir, d'après une expérience constante et comparée, le traitement le plus efficace; indiquer les moyens d'en arrêter le progrès et d'en prévenir l'invasion.

but in general, unless the patient be treated with promptitude and judgment, the disease may be expected to terminate fatally; a new order of symptoms, the second stage of croup as it is called, taking place in the course of the next day.

When the first or inflammatory stage of croup just described has not subsided or received a check, the cough, from being loud and sonorous, becomes husky and suffocative; it resembles the cough which attends tracheal phthisis, and cannot be heard at any distance from the bed; the voice is whispering; the respiration wheezing; the countenance pale; lips livid; the skin motley; the eyes languid; the iris with less colour than natural;* the pupils dilated; the tongue loaded, and with purplish edges; thirst considerable; skin much less hot; and the stools dark and fetid. In this, the second stage, or that of suppuration, the breathing may often be remarked most free in positions which are generally least favourable to easy breathing, as, for example, when the head is low and thrown back. When the breathing is a struggle for life, the patient sometimes will suddenly obtain relief, which, however, in general is only temporary.

From the state described in the last paragraph comparatively few patients recover. The eyes now become hollow; the countenance sinks; the circulation gradually fails; the extremities are cold and swollen; jactitation and drowsiness occur; the respiration becomes frequent, interrupted, and laborious; and, after gasping for a longer or shorter time, the child dies;—the duration of the disease being varied according to the stamina of the patient. When fatal, croup at an average occupies a period of four days. Sometimes, however, the second stage is prolonged for two or three weeks, and the patient, expectorating freely, slowly emerges from a condition which repeatedly had appeared hopeless. Along with puriform fluid, of which the sputa chiefly consist, there is sometimes expectorated a white soft tubular matter like macaroni stewed in milk, which is called the membrane of croup.

Prognosis.—The danger to which a patient in croup is exposed may be easily computed by any experienced practitioner who will bestow some consideration on the first or inflammatory stage of the disease. In this stage the hoarseness and cough (unaccompanied with the pulse of inflammation), how distinctive soever of croup, do not imply the existence of danger; a hard ringing cough, followed by a crowing inspiration, will often take place during several successive nights; and these symptoms may exist without danger, so long as the breathing is free and pyrexia absent. Very active treatment may not be required, but vigilance will be necessary. The medical attendant must be within call, and see the child more than once in the course of the evening, and take care that he is under the eye of a steady and experienced nurse, by whom he may, without delay, be certified of any symptom indicative of stricture of the glottis or inflammation of the bronchi. While the breathing is inaudible and the pulse quiet, all may be considered, so to speak, as safe; but when the child crows in inspiration, when the breathing is audible, the air as if forced through a narrow tube, dry rather than wheezing—a sound which any one may voluntarily produce by contracting the glottis while he inspires,—or when the respiration is cooing or croaking, danger is present; inflammation has seized the larynx, has caused tumour and great irritation there, and has extended into the bronchi. This is no longer a case for *expectation*, but for action. On the other hand, when the cough becomes loose, the voice more natural; when the symptoms of inflammation abate, while no symptom of the second stage exists; we may give all reasonable encouragement. In the stage of suppuration the prognostic is always unfavourable; but a prudent physician in prognosticating the issue of any disease of childhood ought not to deliver himself without reservation; he ought ever to be ready for any contingency unfavourable or favourable; his prognostication ought to be declared, to use the words of a late eminent physician, to be "subject to the uncertainty of all medical opinions."

Diagnosis.—The diseases which are liable to be mistaken for croup are the following:—

1. *Measles.*—This disease often resembles croup so much, that the most experienced physician need not be ashamed of mistaking the catarrhal symptoms, which, with a ringing cough, usher in the former disease, for the latter. This he will the more readily do, unless he knows that the measles are in the neighbourhood, or that the patient, some twelve or fourteen days before, was exposed to their contagion. Upon the efflorescence taking place in the measles, the symptoms resembling croup disappear.

2. *Cynanche pharyngea.*—When inflammation runs very high in this species of quinsy, we have known it extend to the larynx, and croup thereby has been simulated; but cynanche pharyngia will not be mistaken for croup, even under such a complication, if the fauces be carefully inspected, and if it be recollected that cynanche pharyngea is attended with complete dysphagia, whereas in croup the patient can always swallow with ease.

3. *Cynanche membranacea* or *maligna.*—This disease, when the morbid action descends from the fauces into the larynx, is more liable to be mistaken for the croup than any other. In croup, therefore, the fauces, which are scarcely, if at all, inflamed, ought to be examined with care, thus to distinguish it from cynanche membranacea, or any congeneric disease. If the fauces are discovered to be spotted, as it were aphthous, encrusted with a membrane, or apparently sloughy, the disease is not croup. Moreover, cynanche maligna, being propagated by contagion, often occurs in several persons of a family or neighbourhood at the same time, and can be traced from house to house, while croup is non-contagious. When two of a family have been attacked at the same time with croup, which we have often known to be the case, it has always manifestly appeared that both had been exposed to a cold damp atmosphere, or to some other adequate occasional cause.

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* This paleness of the iris, which often attends the advanced stage of diseases, especially of the lungs, and which is a very unfavourable symptom, has, we think, been overlooked.

4. *Hysteria.*—Hysteria, which mimics so many diseases, not unfrequently assumes the character of croup. By the first case of this kind which he witnessed, the writer of this article was so completely deceived that he ordered the patient, a young lady who never had menstruated, to be let blood, and he remained during the operation. Before she had lost more than a cupful of blood, she fell into hysteric catalepsy. The vein, of course, was immediately closed, and by means of draughts of camphor julep, Hoffmann's anodyne liquor, with five or six drops of the acetum opii in each draught, her croup was easily cured: but hysteria exhibited itself in various forms before she finally recovered. Whenever a physician is called to a young lady said to be affected with croup or inflammation of the windpipe, let him bear in mind that hysteria sometimes acts the part of croup to the very life, and even although he cannot detect any overt act of hysteria, let him look narrowly into the history of the patient, and carefully study her diathesis before he delivers his opinion. Moreover, the patient's age will always be a guide to a true diagnosis, croup not occurring in adult age, or even in adolescence, and hysteria being rare before puberty.

Spasmodic Croup.—The symptoms of croup which depend upon stricture of the glottis differ so in degree, (sometimes suffocation appears impending, sometimes the breathing is nearly natural,) as to prove in many attacks the existence of spasm; this, however, is spasm caused by inflammation, for which no antispasmodic will be equal to venesection. That inflammation in this disease often spontaneously is resolved, the spasm depending upon it subsiding at the same time, is unquestionable, and has given rise to a belief entertained by those chiefly who have overlooked the evidences of inflammation, that there is a purely spasmodic species of croup; we therefore take the opportunity which presents itself of observing that the hysteric affection just alluded to is the only species of spasmodic croup with which we are acquainted. The term spasmodic croup has been applied to affections of very different kinds, by which many discussions have been excited. We are convinced that the difficulty attending these discussions has arisen chiefly from that fruitful source of error, the misapplication of terms. The designation spasmodic croup we have reason to believe has often been applied to the hysteric affection which we have just described. It has also been applied to a well-known disease of infancy, which one of our latest authors describes as follows: "Spasmodic croup occurs in very young children, and appears at the commencement of the period of dentition: sometimes earlier, and but very rarely after the child has reached its third year. The crowing noise which some infants make in respiration, and which nurses occasionally consider as a sign of thriving, is nothing more than the air rushing through the aperture of the glottis in a state of spasmodic constriction; and wherever this symptom appears, (however well the infant may seem in other respects,) it is always advisable to pay attention to it, and remove the source of intestinal irritation, which will generally be discoverable. In some instances the constriction is both slight and momentary, and the spasm never produces either unpleasant or dangerous consequences: in others it is longer continued, and the infant works and struggles for breath, becomes purple in the face, and is apparently dying when the spasm begins to relax, and a long-drawn, crowing inspiration sets all things to rights again. . . . . In the fatal cases of spasmodic croup, death is extremely sudden: the infant may be apparently in good health, and in a moment he makes a violent effort to inspire, which occasions something like a faint scream or cry, becomes black or swollen in the countenance, and dies before assistance can be procured." Now this is a graphic description of a disease of which an account will be found in Dr. Clarke's Commentaries on the Diseases of Children, there entitled, "a peculiar species of convulsions in infant children," which has also been sometimes called chronic croup, sometimes inward fits; and which is furthermore distinguished by a clenching of the hands upon the thumbs, and a bending of the toes downward and inward, by which the foot appears slightly clubbed. This affection, which ought never to be called croup, is not attended with cough. On dissection there is no trace of inflammation in the windpipe; the seat of the disease, it can scarcely be doubted, being in the brain.

Having repeatedly observed the symptoms which in children are supposed to constitute a non-inflammatory variety of croup, and to which most frequently the term spasmodic croup is applied, symptoms which may be found in Dr. Good's valuable work, *The Study of Medicine*, embodied under the title of Laryngismus Stridulus, viz., "sense of suffocation commencing in the night; voice shrill and croaking; countenance flushed and swollen; distressing struggle for breath;"—we were naturally anxious to determine their true nature; and as it appeared that these symptoms took place at the time of night when croup is generally at its height; that they were brought on by causes which produce croup; that they occurred in individuals and families liable to croup; that they were most certainly relieved by the internal remedy most efficacious in croup, namely, an antimonial emetic; and, on the other hand, when it was considered that genuine inflammatory croup often invades suddenly and without any catarrhal symptoms preceding, and that its most formidable attacks will often subside as the symptoms of the supposed spasmodic croup are represented to do, without remedial treatment; there appeared to us no sufficient grounds for establishing a spasmodic variety of the disease. A sounder conclusion could not be drawn relative to spasmodic croup than that with which the late Dr. Kellie ends an able letter on this much-contested point. "After embarrassing myself a long time about spasmodic and inflammatory croup, and using my opportunities of observation to the best advantage of which I was capable, with the view of establishing the diagnosis of these two diseases, I came at length to persuade myself that there was truly no essential difference between them, other than what arises from degrees of violence, and the obvious circumstance of intermission and continuance." (See *Dr. Kellie's* Letter, Pathology of the Larynx and Bronchia, by J. Cheyne, M. D., p. 136.)

Predisposing Cause.—There would be less difficulty in explaining the nature of the predisposing cause of croup, did we know why the disease ceases at puberty. The difference between the glottis of a child of three years and of twelve is scarcely perceptible; whereas at puberty the aperture of the glottis is quickly enlarged in the male in the proportion of ten to five, in the female of seven to five; at the same time the bronchi enlarging, and the voice undergoing a corresponding change. Upon the windpipe and bronchial system, changed in their constitution, enlarged and invigorated, the occasional cause of croup is no longer able to produce an adequate impression: it may be conjectured, then, that in the immature state of the organs affected we are to look for the predisponent cause of croup.

Pathology of Croup.—Upon dissection, appearances are displayed which satisfactorily account for the symptoms of this disease. The symptoms, as the reader must have observed, are those of inflammation affecting the air-tubes of the lungs. The sound of the voice, the sense of strangling, (which the writer well recollects, having had a dangerous attack of the croup when he was not a very young child,) prove that the larynx is much affected; while the state of the complexion in the second stage, even when the uneasiness in the throat is relieved, the quickness of the breathing, the cooing respiration, the puriform sputa, would show that the inflammation has extended through all the branches of the bronchial tubes. Nay, the examination of the body after death, explains the sudden relief which the patient sometimes unexpectedly obtains in the second stage of the disease, as also the ease which he finds in positions generally unfavourable to free breathing.

The mucous membrane is found inflamed, and, in consequence of this inflammation, the larynx, trachea, and bronchial tubes are generally lined with a membranous substance, varying in consistence, of the same sort with that which, as has been observed, is sometimes expectorated: this substance, in a fluid form, fills the bronchi. In the trachea it is soon dried, and there it obtains form and consistence; it is often partially detached. Evidences of inflammation may generally be discovered over the whole of the mucous membrane of the lungs; the cavity of the lungs is always full of fluid; the interstitial cells are sometimes filled with serum; nay, we have known parts of the lungs hepatized, and inflammation to extend not merely to the parenchyma, but to the serous membrane, in consequence of which we have seen fluid effused into the cavity of the pleura. In many dissections the lungs have a solid feel, do not recede when the thorax is opened, and cannot be compressed.

The membrane of croup has been found partially detached, which will account for its being sometimes coughed out; and as children often swallow what would be expectorated by adults, there is reason to think that it is much oftener transferred to the stomach, upon which the struggle within the larynx ceases for a time; and this explains the gleams of hope afforded in the second stage, which, however, for the most part are gradually obscured by the steady advance of bronchial inflammation and effusion. The relief obtained in unfavourable positions may be explained as follows: the trachea has its capacity increased by being stretched to the full extent, which happens when the head is thrown backward; whereas when the patient sits, which is generally the easiest posture in difficult breathing, the head falls forward, and the membrane, especially if it be in part detached, being doubled together, fills the trachea at one point, and completely obstructs the passage of the air.

Prophylaxis.—When croup has once occurred in a family, it will probably renew its visits, and will attack the same child or some of the other children on a future occasion; the physician therefore should instruct parents with regard to prevention. If possible, children liable to croup ought to live at a distance from bodies of water. They ought not to occupy warm rooms, or have a superfluity of bed-clothes. Beginning in summer, they ought to be sponged with cold water every morning, and rubbed dry with a coarse towel. In winter and spring they ought to wear flannel next their skin, and to have the neck covered. They ought not to drink fermented liquor. Their diet at all times, although nourishing, ought to be light; and finally, when the weather is cold and damp, and especially during the prevalence of the east wind, they ought not to be in the open air between October and May.

Treatment.—When a child becomes hoarse, and begins to cough, let every kind of stimulating food be withdrawn; let him be confined to an apartment of agreeable warmth; have a tepid-bath; and take a drachm of the following mixture every hour, or every two hours, if it produce sickness:—

℞ Vini ipecacuanhæ ʒiii.
Syrupi tolut. ʒv.
Mucil. acaciæ ℥i. M.

and all danger will probably be averted. Whereas, if no change be made in the quality of the food, and if he be sent into the open air, he will probably undergo an attack of bronchitis or croup.

When the breathing becomes affected in croup, or when there are symptoms of inflammatory fever, an emetic should be given without delay, and blood should then be drawn from the arm, or, in very young children, from the jugular vein, unless very great relief should follow the operation of the emetic.* Next we would give the patient a powder consisting of calomel and James's powder, probably two, three, or four grains of the former, with two or three grains of the latter, and we would then have him put in a tepid-bath, and supplied with diluting drinks. Every third hour, the calomel and James's powder ought to be repeated: if it should not, after a third dose, affect the bowels, a dose of castor oil may be given.

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* We have adopted the following expedient, with excellent antiphlogistic effects, in violent inflammation of the lungs occurring in a robust constitution. Having ordered an emetic to be given, in eight or ten minutes after, before sickness has commenced, we have had a vein opened, and have found, before ten or twelve ounces of blood had flowed, that the patient has become sick, vomited freely, and fallen into a state of colliquation, which has lasted for a considerable time,—a powerful impression being thus made, at a small expense of blood.

The quantity of blood drawn from a child under two years of age ought not to exceed five ounces; in a child of seven or eight it may amount to eight ounces. But one venesection will seldom suffice in a severe case of croup; it will very often be necessary, in two or three hours, to repeat the operation. When a second bloodletting fails to moderate the symptoms, we generally order leeches to be applied to the upper extremity of the sternum; three or four to an infant, ten or twelve to a child of as many years old. Leeches ought not to be applied to the region of the larynx, as children, in croup, will be found most impatient of the degree of pressure necessary to stanch the bleeding when profuse.

If manifest improvement be not produced by the application of the leeches, and if it be judged unsafe to have more blood drawn, a blister ought to be applied to the lower part of the sternum, and a solution of tartar emetic given. The dose of tartar emetic may be from a quarter to a half grain, and this may be repeated, according to its effect, and to the urgency of the attack. Sickness ought to be excited, and hence the dose, if it have no such effect, ought to be repeated in half an hour, and, if great prostration be not produced, the dose ought afterwards to be repeated hourly while symptoms of inflammation continue.

These may appear violent measures, but be it remembered that, in a vast many cases, the fate of the patient will be decided within twelve hours; nay, there are cases in which the inflammatory stage will be over in six hours from the commencement of the disease.

[In mild cases of croup, not preceded by bronchitic or pulmonic disease, in which the child is suddenly attacked with croupy cough and breathing at night, with little or no fever, the disease appears to be more spasmodic than inflammatory, and is generally removed by an emetic, with or without the warm bath. Such cases are often treated at home, without disturbing the medical attendant, by the Hive or Croup Syrup of Dr. J. R. Coxe,—the mel. scillæ compositum of the Pharmacopœia of the United States,—the dose of which, as an emetic for children, is from ten drops to a fluidrachm, repeated every fifteen or twenty minutes, until vomiting is induced.]

With respect to the treatment of the second stage of croup, or that of suppuration, little can be added to what may be found in a work on the Pathology of the Larynx and Bronchia, published by the writer of this article many years ago. In that publication it is recommended to give half a grain of tartarized antimony, dissolved in a tablespoonful of water, to a child two or three years of age, every half hour, till sickness and vomiting are produced; and in two hours after the last act of vomiting the same process is to be recommenced, and so repeated while the strength will admit. The following case suggested this mode of treatment: a child, with disordered bowels, so delicate as not to admit of being let blood, was threatened with croup, every night, for five or six nights. Whenever the breathing became difficult, the child took as much of the antimonial solution as induced vomiting, and invariably with relief to the difficult breathing. Perceiving that in croup, then pretty generally supposed to be a disease of the trachea, every part of the inner surface of the lungs, from the larynx through the ramifications of the bronchial tubes, was in general affected, and considering that nothing could more effectually moderate the vascular action in that organ, and at the same time dislodge the exudation which fills the bronchial tubes, than the solution of tartar emetic, all reliance was placed on that remedy in the second stage of croup, more especially as it was found that bloodletting in that stage only accelerated the death of the patient. The solution of tartar emetic was prescribed the more freely, from a child having been observed to take six or eight grains of tartar emetic, without vomiting being produced. In few cases has the writer known children survive the second stage of croup; in all of these, however, they recovered while using a solution of tartarized antimony: "Emetics he had repeatedly given in the second stage of croup, but in these cases of recovery the patients were kept sick for two or three days with scarcely any interval. With the exception of tartar emetic no medicine with which he is acquainted is entitled to confidence in the second stage of croup: calomel uncombined, as recommended by Rush, he has often given without benefit. Indeed, tartar emetic in croup, so as to produce continued nausea, has been his sheet-anchor since 1799." (Essay on Cynanche Trachealis, or Croup, by *J. Cheyne*, M. D. Edin. 1801.)

As there is in inflammations of the mucous membrane of the bowels a point of time, when life being rapidly on the ebb, a patient may sometimes be rescued by the substitution of opiates and cordials for the antiphlogistic regimen; so also is there, in bronchial inflammation, a time when we may with advantage lay aside all lowering remedies and give burnt brandy and ammonia, to which may be added calomel, with a minute quantity of opium, and the application of spirit fomentations to the surface. Gasping, failure of the pulse, and a clay-cold surface, show that our only faint hope is in cordials: it must be admitted, however, that a clear discovery of the point at which this change of treatment ought to take place is the reward of clinical experience alone, and cannot be made in the closet.

In the treatment of this disease we have but one point more to consider, namely, the propriety of attempting to remove the membrane of croup by means of a surgical operation.

Considerable difficulty will attend this operation. The larynx of a child from two to twelve years of age is a very narrow tube, not more than three-eighths of an inch in diameter; consequently, to admit the introduction of a pair of forceps, the cartilages must be cut across to a considerable extent, involving bleeding from the thyroid veins, which sometimes has been productive of suffocation. But even were the larynx laid open without hemorrhage, disappointment will probably arise from the state of the adventitious membrane, which sometimes possesses so little cohesion as not to admit of being laid hold of by an instrument for the sake of detaching and removing it; nay, in some cases in which the inflammation is intense, there is no appearance of a continuous membrane, the secretion from the inflamed surface existing in the form of shreds and detached portions. « Dans plusiers cas, et tout récemment encore, des médecins très-distingués ont pratiqué la trachéotomie sur des individus affectés de suffocation et de voix croupale, qu'ils regardaient comme dépendantes du croup. L'opération d'abord, et l'ouverture du cadavre ensuite, ont prouvé qu'il n'y avait pas de fausses membranes." — *Guersent Dictionnaire de Médecine*, tome vi. p. 213.

Before having recourse to the operation, supposing it easy, safe, and likely to end in the extraction of the adventitious membrane, it will be proper to ask, is the false membrane in the larynx, which it is the object of this formidable operation to remove, in general the cause of the patient's death? We apprehend not. First, because in several dissections which were long ago made with a view of determining the effect of the membrane of croup in obstructing the larynx, it so happened that within that membrane a space was left for a current of air sufficient to support life: in these bodies the cellular substance of the lungs was distended with serum, the ramifications of the bronchi were filled with puriform matter, by which the air was excluded, and the bronchial membrane was universally inflamed, thereby preventing the arterialization of the blood: the children had perished from the lungs being unable to contain a quantity of air sufficient to support the circulation, and from the bronchial membrane being unable to act upon that reduced quantity. Secondly, because when the membrane of croup, fully formed, is expectorated, the disease is generally fatal, even when all the benefits of the operation are obtained. If the disease were confined to the larynx, *then*, and then only, would bronchotomy be advisable. The following are the very pertinent remarks of Mr. Porter on this subject:—" But bronchotomy has in many cases of croup been successful. True; but where are the thousand instances to the contrary that might be brought against each single one of these? I have performed the operation myself on the child, and have seen it frequently done by others, and in no one case has the life of the patient been saved. I have known and heard of it often, but never understood that it produced a recovery. Most practitioners are fond of publishing cases of successful operations, but are not so willing to make known those of an opposite description, from an idea that these supposed failures might lower them in public estimation; but these detached and solitary expositions of fortunate surgery are calculated to produce very serious injury, if they encourage others to similar attempts, in the hope of similar results. If it was possible to place a list of those cases in which bronchotomy had proved unserviceable, in array against those wherein it had seemed to be useful, it would be scarcely necessary to advance any further argument in proof of its uncertainty; and medical men would rather turn their attention to the improvement of that internal treatment, which will generally be efficacious if resorted to in time, than look for advantage in the performance of an operation from which experience holds out such slender hopes." (Observations on the Surgical Pathology of the Larynx, &c. by *W. H. Porter*, A. M. &c.)

[The testimony for and against the operation has been given elsewhere: (See the writer's *Practice of Medicine*, 2d edit. i. 246: Philad. 1844.) It would appear, that of 140 operations, 112 terminated fatally.]

Improvement of the internal treatment of croup will, in all probability, chiefly flow from the acquisition of more clear and determinate views with respect to the nature of that disease. Some of the latest authors on nosology have formed a juster conception of croup than their predecessors did, having classed it with diseases of the lungs and not of the throat. Swediaur represents croup as a genus of the order Phlegmasiæ, and entitles it Bronchitis; Young as a species of the genus Cauma, or inflammatory fever, under the title of Cauma Bronchitis; and Good includes it under the genus Empresma or visceral inflammations, calling it Empresma Bronchlemmitis, or membrane-like inflammation of the bronchi. The latest of these authors observes that croup essentially consists in an inflammation that spreads through the whole range of the windpipe, from the larynx to the minutest ramifications of the bronchi.

This is a juster view of the matter than that of some of our contemporaries in France, who have endeavoured to identify croup with affections primitively of the fauces, beyond which they often do not extend; affections some of which in their constitution are the opposites to croup. MM. Bretonneau, Guersent, and others, have endeavoured to prove that croup and epidemic angina maligna are one and the same disease; that although there may be some little variety in their seat, there is none in their nature: " M. Bretonneau a démontré que l'angine maligne épidémique est une veritable inflammation pelliculaire, semblable à celle du croup. Il a prouvé ensuite, que ces deux maladies, identiques quant aux altérations pathologiques, ne different que par rapport au siège qu'elles occupent."—*Guersent*, l. c. It is strange, that among a people remarkable for their minute and patient study of disease, and their refined arrangements, croup and cynanche maligna should be considered identical, because of a certain gross resemblance between them, because in both there may often be found an adventitious membrane, and because in the latter, when the diseased action is extended to the windpipe, there may arise some of the symptoms which belong to the advanced stage of the former. What real identity can there be between two diseases, the one caused by cold, the other by contagion; the one always purely inflammatory, the other generically typhoid; the one requiring a decidedly antiphlogistic treatment, the other local stimulants of the most powerful kind, tonic medicines and cordials — bark and wine, according to the procedure of our fathers? If we yield ourselves to this figment of our ingenious neighbours, we must, in the present instance, relinquish one of the great advantages which nosology affords, namely, a ready means of distinction between diseases similar in appearance but different in their essence.

If this attempt at the identification of contraries should succeed, it is obvious that the treatment of croup, which at present is simple, will hereafter be complex, difficult, and uncertain. To bear out this assertion, we shall briefly examine some parts of the chapter which Laennec has written on croup, assuming it as a fair representation of the opinions of his countrymen. I prefer an appeal to Laennec, as (although in point of practice he is often marvellously deficient) the genius of that great observer, and the ability of his translator, have obtained for his treatise on the diseases of the chest, authority in Britain as a work of pathological reference.

Laennec tells us that "sometimes croup is confined to the bronchia and their branches, there being no trace of it in the larynx and trachea." This fact would require to be established. "More commonly, as has been shown by Bretonneau, the inflammation commences on the tonsils or the pharynx, and from thence spreads at the same time downwards to the larynx, and upwards to the cavity of the nostrils, which latter it sometimes entirely covers. Occasionally the false membrane extends to the stomach." Again, "If the disease commences in the fauces, spots of a yellowish or greenish colour, surrounded by a deep red, are at first perceived on the tonsils, the pillars of the veil of the palate, or the back part of the pharynx; these specks gradually extend, unite, and increase in thickness, so as at last to form a complete crust like that of inflamed blood, lining the whole entrance of the fauces, and extending in a greater or less degree into the larynx, trachea, and bronchia." Such incrustations, proceeding from an inflamed membrane, and extending into the larynx, every experienced physician is acquainted with, in cynanche maligna. In scarlatina anginosa also, inflammation and incrustations, extending from the fauces to the larynx, may often be observed; and we doubt not that such appearances are observable in a species of angina which can be classed neither with angina maligna nor with scarlatina anginosa;* but in genuine croup, as it occurs in Scotland and Ireland, never.

If it be objected that the diphtherite of M. Bretonneau and the cynanche maligna of Cullen are different diseases, and that the French physician endeavours to identify with croup a form of angina, under the name of diphtherite, with which English physicians are unacquainted, or have not described in their writings; we would meet the objection by calling the attention of the reader to the following passage in Laennec, wherein a disease, which is either cynanche or maligna or an ideal affection, is upon the authority of MM. Guersent and Bretonneau termed croup. "In some cases of croup, such as occur in hospitals, the state of the system is very different, there being evident marks of a septic change in the fluids of the body: the pulse is but little accelerated, the skin harsh and dirty, the debility extreme, and the breath fetid, even when no gangrenous specks appear: this variety is, by Guersent and Bretonneau, denominated asthenic. Asthenic croup would seem occasionally to be propagated by infection." Asthenic croup! croup with an unaccelerated pulse, fetid breath, and propagated by infection!—Laennec, after describing croup, talks of that affection resulting from a gangrenous angina, in which eschars are distinguishable before the appearance of the false membrane, and in which the gangrene is indicated by its peculiar odour. If the disease of M. Bretonneau be not cynanche maligna, let it henceforth be known as *diphtherite* plastic angina, *angine couenneuse*, or angina membranacea, or let the next observer invent a new name more to his taste; only let him not term it croup, which is a title already applied to an affection of a very different kind, which belongs to another order of diseases.

[Almost all pathologists admit, that the essential character of croup is a violent laryngo-tracheitis, with tendency to the exudation of plastic lymph; but the generality of British and American practitioners regard it to be very different from the diphtheritic inflammation that occurs in diphtheritic stomatitis and pharyngitis, described by Bretonneau and Laennec. In *primary croup*, as it has been termed by Dr. Stokes, the accompanying fever is symptomatic. It is this which is met with in childhood; whilst *secondary croup* is a symptomatic affection, and is the croup of the adult—the *diphtherite* of Bretonneau. Between these two forms of croup Dr. Stokes has pointed out the following differences:

PRIMARY CROUP.	SECONDARY CROUP.
1. The air passages primarily engaged.	1. The laryngeal affection *secondary* to disease of the pharynx and mouth.
2. The fever symptomatic of the local disease.	2. The local disease arising in the course of another affection, which is generally accompanied by fever.
3. The fever inflammatory.	3. The fever typhoid.
4. Necessity for antiphlogistic treatment, and the frequent success of such treatment.	4. Incapability of bearing antiphlogistic treatment; necessity for the tonic, revulsive and stimulating modes.
5. The disease sporadic, and, in certain situations, endemic, but never contagious.	5. The disease constantly epidemic, and contagious. [?]
6. A disease principally of childhood.	6. Adults commonly affected.
7. The exudation of lymph spreading to the glottis, from below upwards.	7. The exudation spreading to the glottis, from above downwards.
8. The pharynx healthy.	8. The pharynx diseased.
9. Dysphagia either absent or very slight.	9. Dysphagia common and severe.
10 Catarrhal symptoms often precursory to the laryngeal.	10. Laryngeal symptoms supervening without the pre-existence of catarrh.
11. Complication with acute pulmonary inflammation common.	11. Complication with such changes rare.
12 Absence of any characteristic odour of the breath.	12 Breath often characteristically fœtid.]

The directions given by Laennec relative to the treatment of croup evince a judgment in this matter, perplexed and distrustful of itself and of the resources of medicine; a disposition to temporise, arising, as we may infer, from his conception of the nature of the subject being clouded.

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* We have seen instances of membranous angina, (occurring during the prevalency of gastric fever,) which did not appear to belong either to cynanche maligna or scarlatina anginosa, and which a French physician would probably have considered as specimens of diphtherite, or, it may be, of croup. We recollect attending in one family two children who died of angina, accompanied with an exudation of concrete lymph, which from the symptoms must have lined the upper part of the windpipe as well as the fauces: this exudation, as it appeared on the fauces, we considered to be a slough, the discovery of Bretonneau not having been made. Many years after, three children, also in one family, were affected in a similar manner, during a similar epidemic constitution, two of whom died.

These cases were not attended with an efflorescence of the skin, nor were they traced to contagion, but we cannot affirm that the disease was not epidemical. At the period of the occurrence of the last three cases, a similar incrustation often covered the fauces of those who were labouring under gastric fever, to which disease we were inclined to think that this angina was allied.

"In doubtful cases," he says, "it would seem preferable rather to omit bleeding than to destroy by injudicious depletion the powers requisite for the separation and excretion of the false membrane." As to the question of bleeding in croup when the disease is once established, no doubt ought to exist, unless perhaps we may hesitate with respect to its stage. If the patient is in the first or inflammatory stage of croup, no experienced physician will omit bleeding; if in the second, or that of suppuration, no physician will propose it. If it were doubtful to which stage the symptoms belonged, it would be preferable to bleed: the anceps remedium ought to be preferred. Bloodletting would probably bring relief if the patient were still in the first stage, and by that measure little would be taken from our hopes were he in the second, from which so few recover. Nothing but the mingling together of incongruities and consequent misapprehensions of croup could have induced an eminent physician like M. Bretonneau to make so dangerous an observation as the following: "I am forced to declare, contrary to the received opinion, that bleeding in croup has done harm, and accelerated rather than retarded the spread of the coriaceous inflammation. I did not abandon this measure till after reiterated proofs of its injurious effects." Physicians need not be told not to bleed in cynanche maligna,—it never was their practice to do so, nor would they willingly bleed in any form of membranous angina; but if they renounce bloodletting in the first stage of croup, which they are taught to do by this sweeping dogma of alleged experience, they will part with the best shaft in their quiver. This is no question of nosological subtilty; if so, we would have kept aloof: it is a matter of life and death.

We shall conclude these observations with one more quotation from Laennec. "All practitioners who have had occasion to see a good deal of this disease, will readily admit that these measures, although very rational and conformable to the results of experience in the treatment of inflammatory diseases in general, are nevertheless rarely sufficient, and that very few well-characterised instances have yielded to their influence." Such a conclusion naturally flows from an attempt to identify a sthenic and an asthenic disease. The reader may be assured that the practice of medicine would be much more satisfactory than it is, were the nature of every disease as well understood, the principles of treatment as clear, and the results as uniform as in the instance of genuine croup. If croup is considered as purely an inflammatory disease, and, in consequence, if the treatment of it be rigidly antiphlogistic, the event, when timely aid is afforded, will be almost invariably favourable. If, indeed, the golden opportunity is lost, and the first stage is allowed to pass without proper assistance being given, while the importance of his profession in his own eyes must be enhanced, the physician can accomplish comparatively little, and the gloomy reflection of Laennec, being modified, may be assented to, namely, that very few well-characterised instances of croup, in the second stage, will yield to the influence of measures even the most rational and conformable to the results of experience. French physicians have of late so honourably and successfully distinguished themselves by their zeal in the prosecution of pathology, that we would readily yield them our confidence, did we not know that such a disposition of mind ought ever to be resisted. The same rule ought to guide our researches into the nature of disease which governs the student in a much higher department of knowledge, viz. "Prove all things;" to which very well may be added on the present occasion, "hold fast only that which is good."

J. Cheyne.

[Notwithstanding the strong remarks of Dr. Cheyne, the difference between idiopathic or primary, and symptomatic or secondary croup, is now, as before remarked, admitted by pathologists; and hence it becomes necessary to make some observations on the treatment of the latter, or what has been called **Croup of the Adult,** which is connected with the same diphtheritic habit that gives occasion to diphtheritic stomatitis and diphtheritic pharyngitis. The remarks as to pathology and therapeutics, made under the latter disease, are equally applicable to the present. Mercury administered so as to affect the system, has been given with the view of diminishing the plastic tendency of the blood, and cases are recorded in which severe diphtheritis of the air-passages appeared to yield to it. Great reliance has, however, been placed on the topical applications recommended in diphtheritic pharyngitis, and especially on the muriatic acid, nitrate of silver, and alum, applied in the manner recommended under chronic laryngitis. (q. v.) Tracheotomy has likewise been advised in diphtheritic laryngo-tracheitis, when urgent symptoms arise that threaten suffocation. Perhaps in such cases it might be more serviceable than in primary croup, in which there is so frequently a combination of bronchial and pulmonary inflammation. It has been proposed also with another view, to introduce through the aperture the local applications that have been found useful. Fragments of the pellicular exudation have been occasionally expelled through the opening, and through it agents, as calomel, have been introduced to act on the morbid surface. Eight grains of calomel, introduced in this way, appeared to M. Bretonneau to afford marked relief in one case. Powdered sugar and powdered alum have been blown into the larynx through the aperture in the same manner. One of the great advisers of topical agents introduced into the larynx, M. Trousseau, seems, however, to have less confidence in them than formerly. They are not much employed. (*Practice of Medicine,* 2d edit. ii. 247: Philad. 1844.)

Robley Dunglison.]

CUPPING. (See Bloodletting.)

CYANOSIS, (κύανος νόσος,) *morbus cæruleus, blue disorder, blue jaundice* of the ancients, a morbid appearance which consists in the skin assuming a blue, purple, or violet colour, especially in those parts where the cutaneous capillary vessels are superficial, as on the cheeks and lips.

This colour may be a symptom of many different diseases; but in some instances it is of so marked a purple, and the accompanying symptoms are so variable, that most physiologists have given this affection its denomination from the colour developed, in preference to one from any assemblage of symptoms; thus constituting the appearance of an idiopathic disease under the appellation of cyanosis. Whether they are justifiable in so doing is questioned by others, who consider the blue colour as indicative of a cachectic or scorbutic habit, or attributable to other causes.

Cyanosis is generally accompanied by difficult respiration, palpitation of the heart with diminution of the natural temperature, an irregular or intermitting pulse, and is often attended with dropsical symptoms, the face especially, in addition to the purple colour, being bloated and œdematous: all these symptoms are much aggravated by any exertion.

When this disorder first attracted the notice of physicians, it was considered to depend on an ulcerated state of the foramen ovale. A few cases where this imperfection occurred were first observed in young subjects, who survived but a short time, the blue colour being intense, and the arterial system supplied with dark venous blood, to the circulation of which through the arteries this tint was attributed. This view was confirmed by the observations of several distinguished anatomists; Senac, Morgagni, and others, reporting that they had in such instances found free communications between the right and left cavities of the heart, which should not have existed. This view appeared to be confirmed by chemical facts, with relation to the blood not having undergone that change in the lungs which vivifies it and fits it for the general circulation; as well as from the symptoms which those subject to such affections had suffered previous to death,—dyspnœa, diminished temperature, weakness, languor, and an engorged state of almost every organ; symptoms generally associated with a want of the due oxygenation of the blood in the pulmonary circulation.

Although cyanosis is often found in connection with an open state between each side of the heart, many cases have also occurred where this imperfection has been absent, and yet in which all the symptoms of cyanosis have presented themselves. Corvisart was one of the first who put this opinion upon record; stating that a permanent blue colour of the integuments was often connected with an unnatural communication between the cavities of the heart, but that many facts induced him to say we could not always arrive at the same conclusion. Several examinations after death occurred to him and others of his contemporaries, in which, though the blue colour had been strongly marked during life, there was no communication between the opposite sides of the heart. The writer of this article has met with some cases of this description, insomuch that for some years he began to doubt the necessary connection between the blue colour of the skin and such a free communication. On the other hand, he has seen several cases where there was a free opening between both auricles and ventricles which must have subsisted for many years, and yet in which there was no cyanosis. In one of these cases, which is published in vol. i. of the Medical Transactions of the College of Physicians in Dublin, (New Series,) the communications were so large and so free that the heart might be considered single, or consisting of one auricle and one ventricle: in this instance there was no cyanosis. Nearly similar appearances occurred to Fouquier, Breschet, and Bertin; and indeed have occurred to all those who have been conversant with the diseased appearances of the heart. One case in particular was met with by Breschet, in which the left subclavian took its rise from the pulmonary artery, and yet there was no blue colour in the parts supplied by the ramifications of that vessel.

[A case has been published by Professor Huss, of Stockholm, (*Gazette Méd. de Paris*, 14 Févr. 1843,) in which there was a communication between the aorta and pulmonary artery without cyanosis; and, more recently, (*Edinb. Med. and Surg. Journ.*: Oct. 1843.) Dr. Craigie has inferred, from a case related by him, as well as from several others, *first*, that the open state of the foramen ovale is rarely a primary and solitary lesion; *secondly*, that when it is a solitary lesion it is not injurious, and the venous blood of the right auricle is not thereby necessarily mixed with the arterial blood of the left auricle; and *thirdly*, that in opposition to what has been hitherto usually taught, the open state of the foramen is, in a large proportion of cases, the means of prolonging life,—an imperfectly oxygenized blood being adequate to maintain vital action. (See ASPHYXIA.)]

It would appear, then, that the mixture of venous with arterial blood will not necessarily produce cyanosis, and that the foramen ovale may be open, allowing this admixture to take place, without the disease in question being the result.

Difficult questions, no doubt, will arise with respect to the consequences of the want of oxygenation in the blood. How is a limb deprived of arterial blood to maintain its heat? How can it preserve its vitality, or retain its colour? It is probably because the circulation is free and unembarrassed, and that there is no obstruction to the depletion of the extreme capillaries. A free and uninterrupted circulation of the blood through the capillary system appears to be necessary to the maintenance of a proper colour in that fluid: stagnation or obstruction impairs it in proportion to its amount. John Hunter included a portion of an artery between two ligatures, thus inducing a stagnation in the intercepted fluid: the result was a change of colour from bright red to purple in the blood thus separated and brought to a state of rest. In all instances also of ecchymosis and petechial extravasion, the effused patches or points assume a purple hue.

A partial stasis, then, in the capillaries, whether venous or arterial, on the surface, should more or less exhibit a purple tinge; and such actually takes place in some morbid states not usually noticed.

Towards the close of fevers terminating fatally, and in other disorders where the functions of the nervous system are much impeded, and the circulation consequently begins to fail, we have often observed the purplish colour in the lips, cheeks, and inside of the mouth; appearances which may be evidently seen long before death. And what is this but a cyanosed state, induced by a stagnation in the capillary system, which now wants its propulsive power, when deprived of the nervous energy?

All the anatomical observations on this subject, however, confirm the fact, that in every instance of cyanosis examined after death, the right cavities of the heart have been found enlarged, dilated, or thickened, whether there was accidentally an opening or not. Corvisart, in particular, enumerates a blue or violet colour of the face and lips as appertaining to organic lesions in the right cavities of the heart, and of the whole venous system, which is in a great measure under their guidance.

In persons of an advanced age, affected with disorders of the heart, this bluish tint is not uncommon, and generally occurs in concurrence with an injected or dark colour of the mucous membranes. In these disorders, towards the close of life, there generally occurs some obstacle to the aortic circulation; this obstacle is generally connected with hypertrophy of the left ventricle; stagnation of blood in the lungs then takes place; and to this succeeds passive dilatation of the right cavities of the heart.

It has been further observed that infants at birth are often cyanosed: this may arise either from the impermeable state of the lungs, or from want of action of the respiratory muscles, especially after tedious and difficult labours. Inflation of the lungs, and other aids, frequently remove this blue tint by exciting respiration.

A want, then, of renovated arterial or oxygenated blood is not the only cause of cyanosis; it appears to depend also on obstructed pulmonary circulation, or other impediments to a free return of the blood to the right cavities of the heart.

A bluish or cyanosed appearance on the surface is known also to take place when nitrate of silver has been administered internally; and this tint has in some instances become permanent. The nitrate, in all probability, is decomposed, and oxide of silver becomes deposited in some part of the superficial cutaneous tissue.

The tinge imparted to the skin in liver diseases differs altogether from the violet hue peculiar to affections of the heart. There is a variety of jaundice described by Dr. Baillie, in the Transactions of the College of Physicians of London, which he calls the black jaundice, where the colour in some degree approximates to the blue tinge; but in the disease described by him the colour is more of a leaden or sooty character. In some few instances, where there was melanosis of the liver, the tint of the skin has appeared to the writer of this article unusually dark, and differing from the ordinary colour observed in hepatic affections. But in all these instances the distinctive characters are sufficiently striking. The state of the circulation and of the respiration is almost sufficient to afford a diagnosis; and there are other characteristic symptoms sufficiently impressive and well known, which need not be enumerated.

Bluish and bruised patches occurring in purpura, and in ecchymosed states, do not require notice further than that they are often connected with obstructed circulation in the lungs and through the heart, or with failure in the nervous energy; but for information respecting these the reader is referred to the article PURPURA.

With respect to the treatment of cyanose affections, it is obvious, when it is considered that they depend on organic lesions, that no general plan suited to cure idiopathic cyanosis can be laid down. The radical or complete removal of such disorders is quite beyond the reach of our art. The treatment must be palliative, depending of course on the precise mode of lesion in the individual instance to be treated.

In all cases it is important to maintain a healthy state of the digestive functions by suitable diet and the use of such medicines as regulate the bowels; as the functions of the liver and other organs of assimilation are principally deranged, for want, in some instances, of blood properly renovated in quality, and in others from the circulation not being sufficiently free and unobstructed through these organs.

Acute pulmonary affections often supervene in subjects of this description; and bloodletting and the other usual aids are required more promptly than in ordinary instances where there is no such complication. But it may be observed that persons advanced in life, or even at earlier periods of existence, when weakened by protracted suffering, do not bear sanguineous depletion well. It has been already remarked also, that sufferers from this disease are frequently affected with dilatation of the right cavities of the heart, and that in a passive form; in these cases bloodletting, which, except in cases of excessive sanguineous plethora, affords only momentary ease, is often followed by great prostration of strength.

When this disease is attended with dropsical symptoms, the remedies usually resorted to in dropsical affections will afford temporary relief.

In those cyanose disorders where the strength is much reduced, the circulation languid, and the temperature below the natural standard, considerable benefit will be derived from wine, cordials, and stimulants; and opiates will control symptoms arising from tumultuous and irregular action of the heart. It is important to maintain a tranquil state of both mind and body; active exertion is nearly precluded in such disorders, but gestation in the open air is most useful in mitigating the symptoms and prolonging life.

[In the **Cyanosis of the New-Born**, *Cyanosis neonatorum*, Professor Meigs (*Proceedings of the Amer. Philos. Society at the Centennial Meeting*, May, 1843) lays great stress on the effect of position. He recommends that the child should be placed on its right side, with its head and shoulders inclined upwards, upon pillows, and be kept in this position for hours. "Upon placing the child thus, its septum auriculorum becomes a horizontal plane, supporting the blood in the left auricle. The weight of that blood presses the valve of the foramen ovale into coincidence with the plane of the septum, and closes the patulous orifice. The succeeding injections of blood take their proper route to the lungs and the system, so that a few acts of the respiratory muscles give sufficient doses of oxygen to the blood to diminish, and to rapidly remove, the excess of carbon, and the child is cured."

Rest is, doubtless, an important agent in many of these cases in establishing the circulation properly; but, on the other hand, a smart blow on the breech not unfrequently effects the same object more speedily. Where the cyanosis is owing to positive malformation, no agency will be of any permanent advantage. (*Practice of Medicine*, 2d edit. i. 489: Philad. 1844.)]

J. CRAMPTON.

[CYNANCHE LARYNGEA. (See LARYNGITIS.)]

CYNANCHE MALIGNA. (See SCARLATINA and [THROAT, DISEASES OF THE.])

CYNANCHE PAROTIDŒA. (See PAROTITIS.)

CYNANCHE PHARYNGEA. (See [THROAT, DISEASES OF THE.])

CYNANCHE TONSILLARIS. (See [THROAT, DISEASES OF THE.])

CYNANCHE TRACHEALIS. (See CROUP.)

CYSTITIS. Cystitis, or inflammation of the bladder, exists in various degrees, from that slightest form which is indicated by an increased secretion of mucus from its lining membrane, to the intensely inflamed state which runs rapidly on to gangrene. Although the several inflamed conditions of the bladder are so intermingled, and pass so gradually one into another, that they require to be viewed in close connection in order to be clearly understood; yet it is useful, for practical purposes, to distinguish between the highly inflammatory or acute cystitis, and the mild or mucous form to which Lieutaud gave the name, now generally applied to it, of *catarrh of the bladder*.

I. ACUTE CYSTITIS.—Acute inflammation of the bladder is known to exist by burning pain in the region of that organ, pain at the extremity of the urethra, tenderness of the hypogastrium, and frequent calls to void urine, which is expelled in small quantities and with distressing spasms. The local symptoms of inflammation are accompanied with the usual constitutional disturbance, ushered in by smart shivering, and denoted by frequent tense pulse, hot skin, thirst, loss of appetite, constipated bowels, and much restlessness. As the disease advances, the pains shoot from the bladder to the anus, the loins, down the thighs, and even to the epigastrium; complete retention of urine takes place, and the distended bladder is felt as an oval tumour rising tense above the pubes. The tenderness, which was at first confined to the hypogastrium, diffuses itself over the whole abdomen; obstinate vomiting of bilious fluid and hiccup take place; delirium comes on, coma or convulsions at length supervene, and death follows. The urine, during the progress of the inflammation, undergoes several changes. At the commencement it is high coloured, as in other inflammations; then becomes mingled with flakes of coagulated albumen, or with blood, bloody urine being more especially observed when the disease has been induced by a poisonous dose of cantharides: as the disease proceeds, the urine acquires a highly offensive odour from its ammoniacal and putrescent condition, resembling more the washings of putrid flesh than human urine.

In this brief sketch of the symptoms of acute cystitis, we may trace the progress of the inflammation from the mucous coat of the bladder, which is the most irritable and the most readily affected by disease, to the muscular tunic, and lastly to the peritoneal. Anatomists have well remarked that the first of these membranes is but loosely connected by cellular membrane to the second, and this still more loosely to the third; but they have erred in believing that acute disease is not speedily communicated from one to the other. A strong and indissoluble sympathy links them altogether, and renders them prone to follow each other in the train of inflammation.

When acute cystitis, instead of commencing within the bladder, is communicated from some of the adjacent parts, as the uterus, the rectum, or the immediately adjoining cellular tissue, the order in which the coats become successively inflamed will be different; and the muscular or peritoneal coat will then be the first affected. It is rare for the whole mucous membrane to be seized at once with inflammation: most commonly it affects the portion lining the neck of the bladder,—sometimes the upper fundus, at other times the anterior part, at others the posterior,—and involving the orifices of the ureters, it obstructs the entrance of the urine, causes the ureters to become distended, and producing pressure upon the kidneys, in this manner speedily proves fatal.

A slight degree of inflammation, or perhaps we ought to say irritation of a mucous membrane, causes an increased secretion from its surface; a greater converts the natural mucus into a puriform fluid; and a still higher degree of inflammation replaces the secretions by an effusion of plastic lymph. This progression we find in the inflammatory affection of many other mucous surfaces besides that of the bladder; of which the exudation of croup, and the false membranes discharged from the alimentary canal and the uterus, are examples. The last change produced in the mucous membrane of the bladder by inflammation is gangrene, which sometimes affects the whole surface; at other times it appears in patches; and in either case it is often found that at one spot all the tunics have become sphacelated, perforation has taken place, the urine has escaped into the peritoneal cavity, and thus destroyed the patient.

When cystitis is prolonged, the mucous membrane becomes ulcerated, and the ulcers, when small, bear no remote similitude to primary syphilitic sores, by their excavated surfaces and raised margins; a fact which we have had opportunities of verifying by dissection. Ulceration is often more extensive, for the whole interior of the bladder has been found eroded, and in some instances the muscular fibres of the organ have been exposed as if by the knife of the anatomist. When ulceration of the mucous coat deepens and penetrates through the other tunics of the bladder, it is usually accompanied by the effusion of plastic lymph exterior to the ulcer, which thus glues the neighbouring parts together, and prevents the escape of the urine: but instances have occurred in which an ulcer of the bladder has terminated in perforation, just as from gangrene, though more slowly, and in like manner has proved fatal. The existence of ulceration of the bladder cannot be certainly known during the lifetime of the patient; but there is always reason to suspect it when disease of that organ has been of long continuance, when the pain is unceasing and excessive, and when pus is distinctly detected in the urine. We must not, however, expect to see pus in a separate state, for it is rarely discharged without a copious admixture of mucus; and this we have known to be the case when dissection revealed ulceration both of the kidney and bladder.

Inflammation of the muscular tunic of the bladder may arise either in the membrane itself, or be communicated from the adjacent textures. In some cases the inflammation of this membrane has induced circumscribed suppuration, (*Chopart*, Maladies des Voies urinaires, t. i. p. 453;) in others the pus has been infiltrated extensively among the muscular fibres (*Bonetus*, Sepulchretum, lib. iii. sect. 23) of the bladder. Extensive abscesses have also been found between the muscular and peritoneal coats; and death has in this manner been produced in numerous cases of lithotomy. Chopart relates a very interesting case of large abscess around the bladder, which occurred in the practice of Moreau. In this case, that distinguished surgeon, after making an opening above the pubes, struck his bistoury into a suspected spot near the anus, and formed a counter-opening, by which he succeeded in saving his patient.

Inflammation of the peritoneal coat is often the close of a fatal disease of the bladder; but that it takes place under other circumstances, without any dangerous consequences, we have sufficient evidence from the old adhesions not unfrequently found connecting this part to the omentum, to portions of the intestine, to the uterus, or to the rectum. In a recent case of diseased prostate, the omentum was found attached to the peritoneal covering of the upper fundus of the bladder.

In all prolonged diseases of the urinary bladder, when frequent ineffectual attempts are made to evacuate its contents, the muscular coat acquires an extraordinary increase of size and firmness, separating into distinct bundles, which project on its internal surface, and leave spaces through which the mucous membrane is forced, thus forming small pouches: this is not the consequence of inflammation, but of increased muscular action. There is, however, an indurated and thickened state of the bladder which is produced by inflammation, and of which Frank has given an interesting example, where he was led to conclude that the whole anterior part of the bladder was in a state of callous induration. (*J. P. Frank*, De Curand. Hom. Morb. tom. v. Retentioa. Mucoso-Lymphat. Vesicæ.)

When acute cystitis is about to terminate favourably, and the violence of the disease has spent its force, the natural mucus of the bladder is increased in quantity and altered in its appearance: it separates from the urine on standing, and forms a ropy gelatinous-like fluid,—the complaint passing into that milder form which has been named catarrh of the bladder.

Causes.—Acute cystitis is induced by direct injuries, as by wounds, contusions, severe exercise on horseback, prolonged travelling in a carriage over rough roads, the introduction into the bladder of foreign bodies, as bougies and sounds: the latter are too often incautiously used: indeed to the examinations made under such circumstances may, in some instances, be traced the fatal result of the subsequent operation of lithotomy. Calculi themselves also produce cystitis, commonly of the mild or chronic form, or catarrh of the bladder. All mechanical obstructions to the discharge of the urine, as strictures of the urethra, enlargement of the prostate gland, and calculi lodged in the neck of the bladder, may prove causes of cystitis. It is induced likewise by exposure to cold and moisture, by excess in drinking, by the internal use of cantharides, and even by their application to a highly sensitive and partly abraded surface, as in Ambrose Paré's case of the lady who was cured of an obstinate eruption in the face by blistering. (Œuvres, fol. p. 777.)

Cystitis also takes place by continuous inflammation spreading along the mucous membrane from the urethra in gonorrhœa, or from the kidneys when they are diseased. It may likewise be communicated by an extension of inflammation from adjacent parts; from the translation of migratory diseases, as gout and rheumatism; or from the recession of cutaneous eruptions: these are, however, causes of chronic rather than of acute cystitis.

Treatment.—The treatment of acute cystitis is to be commenced by free venesection and the warm bath, which may be followed by leeches to the perineum and groins. Should the bladder be much distended, its contents ought to be evacuated without delay, but until some impression be made on the local inflammation, the introduction of the catheter will be exceedingly painful, and productive of no permanent relief. A full dose of calomel ought to be given, combined with a grain or two of opium; and after some hours the bowels may be relieved by castor oil or an emollient enema. Free perspiration ought to be kept up by Dover's powder and the cautious use of antimonials; while warm opiate fomentations or poultices, bags of heated salt, or bladders filled with hot water, are applied to the pubes and perineum. Diluents should be freely given, and the patient restricted to a spare diet of the mildest kind of food. When cystitis has terminated in the formation of abscess, this ought, if within reach, to be evacuated as early as possible by a free and depending opening; while the tendency to hectic is checked by cool air, tepid sponging, and the mineral acids, and the strength of the patient is supported by gentle tonics and light nutritious diet. When ulceration has fairly established itself within the bladder, the resources of our art are rarely of much avail; but we are not warranted in assuming that such cases are altogether incurable; for instances are recorded, and some have come under our own observation, in which health has been restored after calculi and other foreign bodies have escaped by ulceration from the bladder. The sufferings arising from ulceration of the bladder are remarkably mitigated by the full action of calomel and opium, and by the formation of issues over the pubes. Benefit has also been obtained from the administration of uva ursi, pareira brava, and the weak saline and aërated mineral waters.

Of the practice of injecting mucilaginous diluents and mild astringents into the ulcerated bladder, we cannot speak from experience; but we feel strong doubts of its efficacy, and are disposed to think that the operation would prove irritating and injurious.

When acute cystitis has arisen from calculus in the bladder, the obvious remedy is extraction, as soon as the subsidence of urgent symptoms will permit. If cystitis can be traced to the translation of gout or rheumatism, the application of irritants to the situations where these diseases previously existed, and the administration of colchicum, must be had recourse to, while the means already mentioned for subduing inflammation of the bladder are carefully put in practice.

II. Chronic Cystitis.—This form, which has also been called *mucous* cystitis, and catarrh of the bladder, was at one period considered an uncommon disease; the laborious and accomplished Hoffmann designated it "rarus vesicæ affectus." It exists either in connection with a febrile state of the body, or with simple irritation of the bladder or its adjoining and associated parts. Generally it is met with as a sporadic disease, but like the affections of some other mucous membranes, it may prevail epidemically. Gunther describes such an epidemic as prevailing in the autumn of 1782. (*Sömmering*, Ueber die tödlichen Krankheiten der Harnblase und Harnröhre alter Männer.)

Symptoms.—The symptoms of chronic cystitis are, frequent calls to void urine, with more or less pain in the region of the bladder and at the extremity of the urethra, either before or during the process. There is also, in most cases, tension of the hypogastrium, which may depend either on increased sensibility of the bladder, or on distension from urine. In all cases there is discharged along with the urine an increased quantity of mucus, somewhat altered from its natural appearance. Even in health a slight mucous cloud is deposited from the urine in cooling; but in the disease we are now considering, the quantity is greatly augmented, sometimes bearing the enormous proportion of more than one-half of the whole fluid discharged from the bladder. (*Chopart*, tom. i. p. 416.) It is usually voided suspended in the urine, from which after a time it subsides, forming a jelly-like substance, so viscid and tenacious as to be with difficulty detached from the bottom of the vessel. At other times the mucus is discharged from the bladder in a separate state, and of so thick a consistence as to obstruct the passage of the urine, and even to plug up the catheter. The mucus, which was at first pellucid or grey, becomes in the progress of the complaint yellowish, then greenish, sometimes streaked with blood; and at length, when ulceration is established, largely mixed with pus. The character of the mucus is always alkaline, and the urine often of the same nature—ammoniacal, sometimes highly fetid.

The pathological changes discovered in cases of chronic cystitis are chiefly, injection of the mucous membrane, occasionally enlargement of the veins, and when the disease is of long standing, overgrowth and thickening of the mucous tissue. Ulceration is likewise often observed to have taken place at the close of the disease, when it has been severe and long protracted: on other occasions acute cystitis has supervened on the catarrhal affection, presenting after death the usual marks of the disease.

Causes.—Chronic cystitis, or catarrh of the bladder, originates in many and various causes. It has sometimes occurred at the crisis of fevers, as the mode in which solution has taken place; in other instances it has alternated with mucous discharge from the bronchi. Exposure to damp and cold, and to sudden variations of temperature, has given rise to the disease: it has also, as well as the acute form, originated from the translation of gout and rheumatism, and the repulsion of cutaneous eruptions. But its most frequent causes are calculus in the bladder and enlargement of the prostate gland. It occurs much more rarely among the young than the old, and among females than males,—circumstances which are to be explained by reference to the peculiarities of the female, and to the period at which the prostate usually becomes the subject of disease. On more than one occasion we have traced a distinct connection between mucous cystitis and a strumous habit; causes having produced it in individuals of this constitution, which would not have been sufficient to excite the disease in those of a more robust constitution.

Treatment.—Catarrh of the bladder, though classed with inflammatory diseases, rarely requires the employment of depletion, unless when the pain in the region of the bladder is considerable, and then the application of leeches is usually sufficient. Should the disease appear in connection with other mucous discharges, and be accompanied with febrile symptoms, the warm bath, the saline mixture, and opiates; and if it have arisen from the translation of gout or rheumatism, or the repercussion of cutaneous eruptions, free perspiration, and stimulating the part where the previous disease was fixed, will be proper. In gouty and rheumatic cases the administration of colchicum offers the best mode of cure. When the affection depends on an enfeebled constitution or scrofulous habit, the mineral acids, bitters and astringents will be found beneficial. Of astringent remedies the best are pareira brava, uva ursi, kino, and catechu. But in this form of the disease more advantage is often derived from stimulants of the urinary organs, such as the turpentines, and above all small doses of copaiba and cubeb pepper. [Turpentine, with the catheter kept constantly in the bladder, comprised the treatment usually adopted by Dupuytren at one time.] In such cases, also, change of air and sea-bathing on a dry and open shore have been productive of much benefit. The diet ought to be mild and nutritious, consisting of milk, eggs, farinaceous substances, and a moderate proportion of animal food. In almost all instances of this disease, spirituous liquors, even in moderate quantity, are injurious; cases however do occur when a small quantity of generous wine will be found beneficial.

All irritation of the sexual organs should be avoided; and if the patient have contracted improper habits, they must be abandoned before any hope of cure can be held out. The patient ought to spend much of his time in the open air, using gentle exercise: he should reside, if possible, in a dry and elevated situation, and ought to be always warmly clothed, wearing flannel next the skin. More benefit will often be found to accrue from a careful adherence to these directions regarding diet and general management of health, than from the employment of any medicine.

The injection of the bladder with mild diluents, such as barley-water, afterwards rendered more stimulant and astringent by the admixture of some mineral water, has been practised and highly recommended by Dessault, Chopart, and others; and we are inclined to think that advantage may be derived from the mere distension of the mucous membrane under catarrhal disease; just as gleety discharges from the urethra are cured by the introduction of a full-sized sound or bougie.

[Where the disease is manifestly connected with an atonic condition of the parietes of the bladder, the catheter or *sonde à demeure* becomes indispensable, through which appropriate injections may be sent into the bladder.

In the more chronic forms, Sir Benjamin Brodie has injected nitric acid largely diluted. At first, the proportion ought not to be more than one minim to two fluidounces of distilled water; but afterwards the proportion may be doubled. The bladder should be first washed out with a little tepid water; the acid solution should then be injected, and be allowed to remain not longer than thirty seconds. This may be repeated at first every two days, and afterwards every day. Should the injection be followed by pain and other evidences of inflammation, or the urine be tinged with blood, the repetition must be postponed. Injections of tar-water, along with the internal use of turpentine, were highly extolled by M. Dupuytren. (*La Lancette Française*, 8 Avril, 1837.) The iodide of iron would make a valuable injection in such cases. Injections of soot have likewise been used with benefit. (*New Remedies*, 4th edit.: Philad. 1843.) In very obstinate cases, it has been advised by M. Lallemand to cauterize the interior of the bladder. (See the writer's *Practice of Medicine*, edit. cit. ii. 73.)]

When catarrh of the bladder, &c. depends on the presence of a calculus or other foreign body, no cure can be effected without extracting what causes the irritation; but after its removal we sometimes find it necessary to administer tonics and urinary stimulants, such as have been already named, before the discharge will cease. And in all cases of this nature the operation should be immediately followed by a careful attention to the state of the cutaneous surface; and warm clothing should in an especial manner be enjoined.

When the disease arises from enlargement of the prostate gland, the only remedies which can be of avail are those suited to the treatment of that disease.

W. Cumin.

DEAD, (PERSONS FOUND)—Under this head we propose to treat of those causes by which life is suddenly or quickly extinguished in persons previously in the apparent enjoyment of good health. Cases of this kind are peculiarly the objects of legal investigation by the coroner; and as all medical men are liable to be called on to assist him with their professional information and opinion, it is of the utmost importance that clear notions of the true nature of the phenomena that present themselves should be entertained. The object of such inquiry being to ascertain whether death was natural or owing to some accidental cause, the whole subject of sudden death may be conveniently arranged under two heads,—namely, 1. sudden death from natural causes: 2. sudden death from violent causes; comprehending under the latter every variety, whether the result of accident or of criminal intention.

Our first duty on the discovery of a supposed dead body, is to ascertain whether any spark of life still remain, by rekindling which animation may be restored; and this leads us, before entering on the causes and phenomena of sudden death, to consider the states of body that may resemble death, and to point out the means of discrimination between those cases in which life is really extinct, and those in which the exercise of the vital power is only suspended. Nothing is more certain than death; nothing is at times more uncertain that its reality: and numerous instances are recorded of persons prematurely buried, or actually at the verge of the grave, before it was discovered that life still remained; and even of some who were resuscitated by the knife of the anatomist. Pliny, who devotes an entire chapter to this subject, entitled "De his qui elati revixerunt," amongst other instances gives that of the Roman consul Avicula, who being supposed dead was conveyed to his funeral pile, where he was reanimated by the flames, and loudly called for succour; but before he could be saved, he was enveloped by the fire and suffocated. Bruhier,* a French Physician, who wrote on the uncertainty of the signs of death in 1742, relates an instance of a young woman, upon whose supposed corpse an anatomical examination was about to be made, when the first stroke of the scalpel revealed the truth: she recovered, and lived many years afterwards. The case related by Philippe Pue is somewhat similar. He proceeded to perform the Cæsarean section upon a woman who had to all appearance died undelivered, when the first incision betrayed the awful fallacy under which he acted. A remarkable instance of resuscitation after appearent death occurred in France, in the neighbourhood of Douai, in the year 1745, and is related by Rigaudeaux, (Journal des Sçavans, 1749,) to whom the case was confided. He was summoned in the morning to attend a woman in labour, at a distance of about a league. On his arrival, he was informed that she had died in a convulsive fit two hours previously. The body was already prepared for interment, and on examination he could discover no indications of life. The os uteri was sufficiently dilated to enable him to turn the child, and deliver by the feet. The child appeared dead also; but by persevering in the means of resuscitation for three hours, they excited some signs of vitality, which encouraged them to proceed; and their endeavours were ultimately crowned with complete success. Rigaudeaux again carefully examined the mother, and was confirmed in the belief of her death; but he found that, although she had been in that state for seven hours, her limbs retained their flexibility. Stimulants were applied in vain; and he took his leave, recommending that the interment should be deferred until the flexibility was lost. At five P.M. a messenger came to inform him that she had revived at half past three. The mother and child were both alive three years after. There is scarcely a dissecting-room that has not some traditional story handed down of subjects restored to life after being deposited within its walls. Many of these are mere inventions to catch the ever-greedy ear of curiosity; but some of them are, we fear, too well founded to admit of much doubt. To this class belongs the circumstance related by Louis, the celebrated French writer on medical jurisprudence. A patient who was supposed to have died in the Hôpital Salpêtrière, was removed to his dissecting-room. Next morning Louis was informed that moans had been heard in the theatre; and on proceeding thither he found, to his horror, that the supposed corpse had revived during the night, and had actually died in the struggles to disengage herself from the winding-sheet in which she was enveloped. This was evident from the distorted attitude in which the body was found. Allowing for much of fiction with which such a subject must ever be mixed, there is still sufficient evidence to warrant a diligent examination of the means of discriminating between real and apparent death: indeed, the horror with which we contemplate a mistake of the living for the dead should excite us in the pursuit of knowledge by which an event so repugnant to our feelings may be avoided.

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* "Dissertation sur l'incertitude des signes de la mort, et l'abus des interremens et embaumens précipites." Bruhier mentions 180 cases in which persons still living were treated as dead; of these, 52 were buried alive, 4 were opened before death, 53 revived spontaneously after being placed in their coffins, and 72 were supposed to have died when they really had not.

Life consists (at least as far as we can perceive,) in the presence of a preserving principle, proper to all organized beings, and peculiar to each species, which opposes itself continually to the influence of the physical and chemical agents that surround us. The effects of these agents in altering the forms and nature of inorganic substances we daily witness, while our frames resist them in every latitude. This power, in conjunction with sensation and motion, constitutes the state of life; a state which subsists as long as this power remains. But we do not see this power; it only renders itself sensible by the motions given to the heart, lungs, and other organs; and it is by the existence of these motions, that we generally judge of the existence of life. This isolated abstract principle cannot subsist, as far as we know, without the instruments by which it makes itself visible; it is for this reason that these are to be particularly considered on the present occasion, without in the least, however, diverting us from the consideration of a great first cause. If life depends upon the presence of a force or power continually opposed to the action of physical and chemical laws, real death will be the loss of this force, and the abandonment of organized bodies to these agents; while apparent death will be only the suspension of the exercise of life, caused by some derangement of the functions which serve as the instruments of vital action. This suspension must last for a considerable time, if we may judge by the cases collected by credible authors, to some of which we have alluded, and by the numerous instances of drowned persons restored to life after long submersion. From this definition of life and death, it would follow that putrefaction is the only evidence of real death; but in many instances it would be attended with much inconvenience, and often with danger, to wait for this confirmation of the extinction of life. In malignant diseases, and during times of severe general sickness, the keeping of bodies disinterred until putrefaction announced the reality of death, would be a measure fraught with considerable risk to the lives of the survivors. It then becomes desirable that we should be acquainted with those signs by which we may judge that life is extinguished by the interruption of its functions.

As respiration is a function most essential to life, and at the same time the most apparent, the cessation of it may be considered as an indication of death. But as in certain diseases and states of great exhaustion it becomes very slow and feeble, so as to the casual observer to appear quite extinct, various methods have been adopted for ascertaining its existence. Thus, placing down or other light substance near the mouth or nose; laying a vessel of water on the chest, as an index of motion in that cavity; holding a mirror before the mouth in order to condense the watery vapour of the breath; have all been proposed and employed, but they are all liable to fallacy. Down, or whatever substance is employed, may be moved by some agitation of the surrounding air; and the surface of a mirror may be apparently covered by the condensed vapour of the breath, when it is only the fluid of some exhalation from the surface of the body. We, therefore, agree fully with the judicious observations of Dr. Paris (*Paris and Fonblanque*, Med. Jur. vol. ii. p. 10,) on this subject. "We feel no hesitation in asserting that it is physiologically impossible for a human being to remain more than a few minutes in such a state of asphyxia as not to betray some sign by which a medical observer can at once recognise the existence of vitality; for if the respiration be only suspended for a short interval, we may conclude that life has fled for ever. Of all the acts of animal life, this is by far the most essential and indispensable. Breath and life are very properly considered in the Scriptures as convertible terms; and the same synonym, as far as we know, prevails in every language. However slow and feeble respiration may become by disease, yet it must always be perceptible, provided the naked breast and belly be exposed; for when the intercostal muscles act, the ribs are elevated, and the sternum is pushed forward: when the diaphragm acts, the abdomen swells. Now this can never escape the attentive eye: and by looking at the chest and belly, we shall form a safer conclusion than by the popular methods which have been usually adopted."

The absence of the circulation of the blood has been looked on as a certain indication of death; but this is a test not much to be depended on, for it is well known that persons may live even for hours, in whom no trace of the action of the heart and arteries can be perceived. In applying this test, it is necessary to remember that it often occurs that the pulse at the wrist cannot be felt if the limb be extended or everted; but if it is bent, and the hand turned inwards, it becomes perceptible. We should, therefore, perform this movement, by which the artery is relaxed, and the passage of the blood is facilitated when only feebly propelled. Sometimes, also, the artery can be felt between the thumb and first metacarpal bone when it is not to be found at the wrist. It is well to seek for the artery at the bend of the arm, as the pulse can often be felt there after it has left the wrist. In these examinations it is necessary to press very lightly, lest we should obliterate the pulsation altogether; and care should be taken to guard against mistaking the beating of the arteries in one's own fingers for that of the artery under examination. The trial should be made at every part where large arteries pass; and sometimes the proceeding of laying the body on the left side, and placing the hand under the region of the heart, may be adopted. The stethoscope may be used with great advantage in these cases, as any motion of the heart will be sure to become sensible through the aid of this instrument.

The temperature of the body has also been proposed as a guide, but this is very fallacious, as it is well known that the cooling of a body after death is influenced by many circumstances, such as age, habit of body, and the disease of which the person died. With respect to age, it has been observed that the bodies of young persons retain their heat longer than those of old. In fact, in old age, the winter of life as it has been termed, death is scarcely any thing more than to become cold; and in those cases the temperature of the body is rapidly reduced to that of the surrounding medium. Hence we derive a caution in judging of priority of death among a number of bodies overwhelmed by the same accident; for the body of a young person found warm, and that of an old one found cold, would not indicate that the former had survived the latter. This will be more fully treated of in another article. (See SURVIVORSHIP.)

The habit of body has also been observed to exert an influence over the rate of cooling after death, and it is found, *cæteris paribus*, that fat bodies lose their heat sooner than lean, but putrefy sooner. The disease which has destroyed life is a powerful controlling agent in the loss of temperature after death. Thus it has been long known that in apoplexy the body retains its heat for a considerable time. This has been particularly noticed by Portal. Again, in that disease or accident frequently witnessed in tropical climates, the "coup de soleil," we are informed by Badenoch that the bodies of the sufferers remain warm much longer than in other forms of death. In most kinds of asphyxia except that by drowning, but especially in asphyxia by noxious gases, the dissipation of the animal heat is greatly delayed. In cases of the latter description, Orfila found the heat preserved for twelve hours after death; and we are informed by Samoelowitz, that during the great plague at Moscow, the bodies of those who were speedy victims to that disease preserved their temperature much longer than the bodies of those who die by ordinary diseases. Besides these cases in which the animal heat is preserved to an unusual length of time after death, there are others in which it is rapidly lost during life, and even when there is no danger of death, as in some forms of hysteria, and in syncope. It is also an effect of submersion in water, and is usually observed in the bodies of those restored to life after drowning. Flexibility of the limbs succeeding their rigidity is one of the most characteristic signs of death: we say succeeding their rigidity, because so long as the limbs are flexible, if the flexibility has not succeeded stiffness, we may presume that there are some remains of life. We are indebted to Nysten and Louis for some valuable observations on the occurrence and duration of the cadaverous stiffness. The rigidity of the muscles commences in the trunk and neck; it then spreads to the thoracic extremities, and finally reaches the legs and feet, and in subsiding it follows the same course. Its duration is in proportion to the lateness of its occurrence, it being found to continue longer in those cases in which it commences latest. Its energy and duration are always in a direct ratio with the degree of development and energy of the muscular system at the moment of death: thus it is extremely strong in the bodies of athletic individuals, in those who die of tetanus, or who are asphyxiated by noxious gases whose deleterious action does not affect the contractility of the muscles. In all animals, the moment when stiffness commences is that in which the vital heat appears to be nearly extinct. Professor Louis, from observations made upon more than five hundred subjects after death, found that at the moment of the absolute cessation of the vital movements, the articulations began to become stiff even before the loss of animal heat. Foderé has verified the justness of this observation several times in hospitals, and concludes that the flexibility of the limbs is one of the principal signs by which we may judge that a person is not dead, although there is no other sign of life. During the whole time this contraction of the muscles continues, they resist the action of chemical forces, and it is only when suppleness is restored that putrefaction commences. Nysten regards this stiffness as a measure of the resistance opposed by organic to chemical forces. Life on the point of extinction seems to take refuge in the muscles, and there causes the spasms we speak of, and during their continuance is able to resist the operation of chemical forces.

The occurrence of the cadaverous stiffness is subordinate to the same causes that influence the loss of temperature. We have seen that old age favours the dissipation of animal heat, and in like manner it is observed that the muscular rigidity comes on soonest in the bodies of old persons. The habit of body in which the temperature is longest preserved is that in which stiffness of the limbs is slowest in its invasion; thus the bodies of full and fat persons remain longer flexible than those of meagre and lean. And again, those diseases which are followed by a long continuance of warmth are also remarkable for leaving a corpse in an equal degree flexible; while those in which the body is rapidly cooled, as hæmorrhage for example, favour the approach of the muscular spasm; and after death from these, the body becomes soonest and sometimes suddenly stiff. From this concurrence between the spontaneous cooling of the dead body, and the supervention of the cadaverous stiffness, it might be presumed that accidental cooling would be followed by a similar effect; and this is precisely what takes place; for bodies left exposed in cold situations, as on a field of battle, are found to become rapidly stiff.

The rigidity of the body is a criterion of great value, as it points out the general contraction of the muscular fibre that occurs shortly after dissolution; but in regarding it as a test of death, it is necessary to guard against mistaking the stiffness that arises from other causes for the cadaverous stiffness. In persons frozen but not yet dead, or, in other words, susceptible of reanimation, the rigidity of the body is very great, but on close examination it is found not to be confined to the muscular system, but to pervade all parts of the body. The breasts, belly, and skin, are all equally hard with the muscles, to which alone the stiffness is confined in that from death. This, coupled with the crackling noise caused by forcible flexure of a joint, will be sufficient mark of discrimination between the two. Moreover, it can scarcely be a source of error, because it is an effect of the accident to which the person has been exposed, and if it does not yield to the appropriate remedy (the gradual application of heat), it will be an indication that the subject is really dead.

The stiffness that occurs in certain forms of syncope and convulsive diseases can never be confounded with cadaverous rigidity, if proper attention be paid to the facts connected with it; for in the former case it takes place immediately after the invasion of the disease, and always precedes apparent death, while the body still preserves a considerable degree of warmth; whereas the cadaverous stiffness is not observed until some time after death, and when the heat of the body is scarcely sensible. In all stiffness of this kind there is much difficulty in moving a limb; so far it resembles that from death; but after having bent the limb, on ceasing to apply the force, it immediately flies back to its former position; while the dead limb, on the contrary, remains in the position in which it is placed. If death really takes place in any of these convulsive diseases, the muscular contraction ceases with the extinction of the nervous influence to which it was owing, and the true cadaverous stiffness succeeds at the proper time, and runs its usual course. But above all, the termination of the cadaverous rigidity in flexibility serves to distinguish it from every other, and is a certain indication of dissolution.

That peculiar cast of countenance termed from its first describer the *Hippocratic*, has been regarded by some as another sign upon which reliance may be placed in judging of the reality of death. It is thus described by Hippocrates: "The forehead wrinkled and dry; the eye sunken; the nose pointed, and bordered with a violet or black circle; the temples sunken, hollow, and retired; the ears sticking up; the lips hanging down; the cheeks sunken; the chin wrinkled and hard; the colour of the skin leaden or violet; the hairs of the nose and eye-lashes sprinkled with a yellowish white dust." Such is the alteration in the human physiognomy that usually takes place after death. But it is also produced by the near approach of death; often by the sight of imminent danger; and is also commonly observed in criminals at execution, whatever may be the degree of tranquillity assumed. Moreover, those who perish by sudden death, or of short diseases in which dissolution is not expected, preserve their usual physiognomy; while, on the other hand, the countenance may be pale, ghastly, and contracted in nervous and hysterical affections without extinction of life. Finally, there are some individuals whose integuments during life have a leaden and cadaverous aspect, and whose countenance during natural sleep puts on an appearance little removed from the Hippocratic. From these causes we think that little reliance can be placed on the countenance as a test of death.

The changes that take place in the eye after dissolution are remarkable, and have been regarded by some authors as satisfactory indications of death. These are, the cornea becoming opaque, and covered with a thin slimy membrane, which breaks in pieces when touched, and is easily removed by wiping; and general flaccidity of the eye-ball, which may be perceived by placing the finger on the upper eye-lid and moving it gently over the surface of the eye; when the point of the finger will sink on coming over the cornea, and a distinct ring will be felt, marking the attachment of this membrane to the sclerotic coat. Certainly these signs are valid in many forms of death, but they do not exist in all, and are therefore not infallible. The reason why they are sometimes present and at others wanting, is evident when we consider the causes upon which these changes depend. The cornea owes its brightness mainly to the tension of the eye-ball, produced by a full secretion of the humours. This is proved by evacuating a portion of the humours of a recent eye, when the cornea will become flaccid and opaque; or by taking an eye some time dead, and with the cornea already opaque, and compressing the humours towards the anterior part, when the cornea will reassume its brightness. We find the appearance of the living eye influenced by the same cause, and hence we see the dim cornea in very aged and meagre persons produced by a deficiency in the ocular in common with every other secretion. We do not speak of the arcus senilis, but of the general opacity of the cornea observed in such individuals. Hence we can understand why in death after long illness, when the powers of reparation have been for a length of time impaired, the eye should exhibit its want of fullness by a flaccid and dim cornea. On the other hand, we are led to expect, when death takes place suddenly in a healthy person, that the eye will preserve its lustre for a much longer period; and this experience confirms; for it has been observed that after death by apoplexy, asphyxia, prussic acid, &c. the eyes preserve their integrity for a considerable time, owing to their being at the time of death in a state of tension by the due secretion of the vitreous and aqueous humours. Moreover, it has been observed that in severe diseases of long continuance, and even in some affections of the mind, the eyes have become dim and shrunken, although death may not happen, and thus another source of fallacy arises.

Different physical tests have been proposed for doubtful cases, such as incisions, burns, blisters, cupping, flagellation, &c.; but of these it may be said that there are so many instances of disease affecting the nervous system, in which their application causes no sensation in the sufferer, that they will be still less likely to produce any effect on the sensorium in a body nearly deprived of life. The influence possessed by galvanism in the production of muscular contraction in the living body has led to its adoption as a test of death; and with certain limitation it is one of considerable value; for although the muscles retain their contractility for some time after absolute death, yet if the death be real, they soon lose it, and become insensible to this stimulus. On the other hand, if the least spark of life remain, the contractility will be also present, and on the application of the galvanic fluid it will be evidenced by contraction. Galvanism thus becomes a test not of life, but of the reality of death, for if the muscular fibre does not obey it, there can be no doubt that vitality is extinguished. It should be recollected, however, that different parts of the muscular system retain their contractility, and consequently their obedience to the galvanic stimulus, for different periods after death. (Dict. des Sciences Méd. art. *Mort.*) Nysten found, in the body of a guillotined criminal which was given to him immediately after execution, that the contractility of the left ventricle was extinguished in forty-nine minutes after decapitation; that of the stomach, intestines, and urinary bladder continued for fifty-six minutes; while that of the right ventricle and diaphragm remained for two hours. He found the locomotive muscles lose their contractility in proportion to their free exposure to the atmosphere, and those that were not at all exposed continued excitable during four hours; but the auricles of the heart, although in contact with the air during the whole time, did not cease to contract, when stimulated for four hours and forty minutes. From many similar opportunities of observation possessed by Nysten, he concludes that the muscles cease to be influenced by galvanism after death in the following order: 1. left ventricle; 2. intestines and stomach; 3. urinary bladder; 4. right ventricle — this retains its contractility under galvanism for one hour; 5. œsophagus, for half an hour longer; 6. iris; 7. muscles of animal life; 8. auricles.

We have now alluded to the chief criteria of real death; and we may conclude this part of our subject by stating that those most entitled to consideration are flexibility subsequent to rigidity of the joints; loss of contractility of the muscles under galvanism; and incipient putrefaction. These are not liable to any important fallacies: the rest are, for the reasons already mentioned, more or less equivocal.

It now remains, before we proceed to consider the causes of sudden death, to make a few observations on the changes which the human body undergoes after dissolution; and we prefer doing so in this place, because the subject naturally follows that which we have just discussed, and also because a knowledge of the attendant phenomena and their causes is often of the highest importance to the medical jurist in enabling him to determine the length of time a body submitted to his inspection may have been dead; or the period at which dissection may be attempted with a prospect of useful results. It is sometimes of the utmost moment to the surviving relatives of an individual found dead, that it shall be determined at what time death took place; of this a case mentioned by Dr. Male (Elements of Juridical Medicine, p. 101) serves as a good illustration: At the Lent assizes, held at Warwick in the year 1805, a cause was tried in which a gentleman, who was insolvent, left his own house with the intention (as it was presumed from his preceding conduct and conversation) of destroying himself. Five weeks and four days after that period, his body was found floating down a river. A commission of bankruptcy having been taken out against the deceased a few days after he had left his home, it became a question of great importance to the interests of his family to ascertain whether he was living at that period; for if it could be proved that he was not, his property would remain untouched by the legal proceedings. From the changes which the body had undergone, it was presumed that he had drowned himself the day he left home; and to corroborate this presumption, the evidence of Sir George Gibbes of Bath was required, as he had lately been engaged in experiments on the changes produced in animal substances by immersion in water. He stated on the trial that it required five or six weeks to effect changes similar to those observed in the body of this individual; and upon this evidence the jury were of opinion that the deceased was not alive at the time the commission was taken out, and the bankruptcy was accordingly superseded.

A few weeks back the writer of this article, in passing along the canal on the south side of Dublin, on a Saturday, observed a crowd collected on the bank; on approaching, he discovered the object of their attention to be the body of a man recently withdrawn from the water. None of the bystanders knew anything of the individual, or of the time at which he had been drowned; but, from the fresh appearance of the body, the general belief was that he had fallen in the preceding evening. From certain appearances (to be more fully treated of hereafter) the writer was induced to doubt the truth of this supposition, and to assert that the man had lain in the water for at least five days. An accidental circumstance served to corroborate this opinion. Seeing the individual well dressed, and not observing any hat, the writer inquired whether one had been found with him, to which he received a negative answer; when a boy, who lived in the neighbourhood, came forward and mentioned that a hat and handkerchief were found in the water at that place on the previous Tuesday morning, just five days from the time of finding the body. These articles were afterwards proved to have belonged to the deceased. This was a case in which, from the appearances presented by the body, very positive testimony could have been given as to the length of time that had elapsed since death; and in case any question similar to that in the preceding instance was pending, such testimony must have been of the highest importance.

The changes that take place in the body after death may be divided into those that occur before and those that follow the invasion of putrefaction.

To the first stage belong diminution of temperature, contraction of the muscles constituting cadaverous stiffness, and lividity of certain portions of the surface. We have already taken notice of the causes by which the loss of heat and muscular rigidity are influenced, and therefore it is unnecessary to allude to these phenomena at present. The extensive lividities usually observed on the back parts of the body shortly after death, are entirely owing to gravitation; the blood, still fluid, and no longer kept in its proper course by an impelling power, obeys the physical law by which it is inclined to seek the most depending situations, and this takes place in the interior as well as on the exterior of the body; of which we have examples in the gorged state of the posterior portion of the lungs, and in the vascular turgescence exhibited by the gastro-intestinal mucous membrane in the lowest part of depending convolutions. (*Trousseau*, Dissertation inaugurale. Paris, 1825.) That all these appearances are the result of gravitation is proved by the fact that we can produce them in other situations by altering the position of the body; thus, if it be turned on the face, instead of remaining as it usually does on the back, the skin of the face, breast, belly, and anterior parts of the limbs will be found livid, while the back will retain its natural colour, and the congestions in the interior of the body will all be found in the anterior part of the organs. Nay, the lividity, having formed on the back, can be made to disappear, if the body is turned before it becomes cold, and the blood coagulates. Of this the writer has convinced himself by experiment. As it has happened that these lividities have been mistaken for the effects of violence, and suspicions of murder having arisen therefrom, it is necessary, in judging of such appearances, to take into consideration the attitude in which the body may have lain during the first few hours after death, the great extent of surface occupied by them, and the absence of any effusion or infiltration of blood into the cellular tissue. We shall have to recur to this subject when we come to treat of the effects of blows on the dead body, and their resemblance to the consequences of injuries inflicted during life.

The second stage is marked by the occurrence of putrefaction. This is a process peculiar to organized substances, and it seems to follow as a consequence of the manner in which their ultimate elements are combined during life. These elements are few in number—oxygen, hydrogen, carbon, and nitrogen constitute the great bulk of organized substances. Other elements, as phosphorus, sulphur, iron, lime, potassa, and silica, are occasionally present, but in quantities so small as not to invalidate the statement just made. But we find these elements combined in various proportions, and thus constituting the different proximate principles of which our bodies are made up, such as fibrin, albumen, gelatine, urea, stearine, elaïne, cholesterine, &c., which in composition differ from each other chiefly in the proportion of their component elements. Now these combinations are not such as the ultimate elements have the greatest disposition to form; in other words, their natural affinities lead them to different combinations and to the production of more permanent compounds, namely, water, carbonic acid, ammonia, &c. This disposition is controlled by vitality, and as long as it continues, the operation of chemical laws seems suspended; but as soon as life is extinguished, the elements abandon their former combinations, and enter into new ones, and this constitutes putrefaction. The presence of nitrogen expedites this process, and hence vegetable substances, which with few exceptions are deficient in this element, undergo the change more tardily and imperfectly; and some animal substances, as, fats, oils, cholesterine, in which nitrogen is absent, are little disposed to the putrefactive fermentation.

The human body, in common with other animal substances, suffers this dissipation of its principles after death; but as the phenomena attending this change are not constant as to time, order, and results, it is necessary to inquire into those causes that influence its course.

The conditions necessary to the speedy putrefaction of a dead body are the exposure to air, moisture, and a moderate degree of heat. The presence of air, however, does not appear to be essential, although its exclusion retards the process. Putrefaction in vacuo was denied by Gay-Lussac, but some experiments by Guntz of Leipsic have proved the possibility of its occurrence. He took some pieces of human flesh, and having freed them from any air that might be lodged among the fibres by plunging them into mercury, he passed them into jars inverted over and filled with the same fluid. The flesh rose to the top of the jar, and the apparatus was kept in a moderate temperature. Putrefaction went on, but at a slower rate than if the air had been admitted. In a few days the flesh became soft and pulpy, and of a grey colour. Gas was generated, which was found to be carbonic acid gas, and some highly fetid fluid covered the surface of the mercury: the flesh had lost one-third of its weight. He also ascertained that blood alone will purify in vacuo. For this purpose he placed the forefinger of his left hand under an inverted jar filled with mercury, and then made an incision into the integuments. The blood rose to the top, and in five days it was found to be undergoing putrefaction; an accident by which the apparatus was upset prevented an analysis of the product. These experiments show that though the presence of air expedites the process, it is not essential.

A moderate temperature is a most important condition. If the heat be too high, it prevents the occurrence of putrefaction by rapidly dissipating moisture; and if too low, the process is equally arrested, and, it would appear, from the same cause,—for the fluids being converted into solids by congelation, are as efficiently deprived of the power of assisting putrefaction (so long as they continue in that state) as if they were altogether removed. The practice of packing salmon in ice for the purpose of preserving it fresh during long voyages is a familiar illustration of this point. But the most extraordinary instance on record is the preservation of the mammoth discovered some years ago in Siberia enclosed in a block of ice, on breaking into which the animal was found entire and fresh. This being a specimen of an extinct species of animal, it is of course impossible to calculate the number of centuries it must have been enveloped in its icy tomb. Below 59° Fahrenheit, the process is slowly performed, and at 32° it is altogether suspended. The temperature most favourable to its perfection is from 60° to 80° or 90°. This is the range of the thermometer during our summer, and hence at this time putrefaction most readily goes forward.

Moisture is an indispensable condition. This is shown by the readiness with which substances otherwise disposed to putrefy are preserved by drying, as smoked meats, fish, &c.; and still more strikingly by the preservation of animals buried in sand. Caravans in crossing deserts have been overwhelmed by the shifting sands, and the bodies of men and camels have lain for centuries until exposed by the same cause, when they were found dry, shrunken, but without any signs of having undergone putrefaction. Instances of this kind have occurred in Egypt, Arabia, and Persia. Chardin (Traité des Exhumations Juridiques, par MM. Orfila et Lesuer, vol. i. p. 382,) mentions the preservation of certain bodies in the sands of Corassan (Persia), where they had been buried two thousand years.

It is supposed that the preserving power possessed by some burying-places, as the vaults of the Cordeliers at Toulouse, and those of St. Michan's, Dublin, is owing to the dry and absorbent nature of the surrounding soil. In these situations bodies rarely putrefy, but they undergo a process of natural mummification. The products of putrefaction, when conducted under favourable circumstances, are — water, ammonia, carbonic acid, carburetted hydrogen, sulphuretted hydrogen, phosphuretted hydrogen, nitrogen, and hydrogen gases, and there remains a friable matter of a deep brown colour containing the salts of the body and some carbon.

From these cursory observations it must appear that the transformation of the dead body will be influenced by the medium in which it is placed. The media existing naturally, and to which all others may be referred, are the earth, air, and water. But as these do not exist in a purely separate state, being found mixed together, —as air impregnated with water, water with air, and earth with both, — the term *group* may be given to these combinations. Thus we have earthy group, watery group, and aërial group, by which are meant the combinations usually existing between these media. A group is called cold when the temperature is below 32°; cool between 32° and 60°; warm between 60° and 100°; and hot when it is above 100°.

The metallic oxydes and salts which enter into the composition of the earth exercise but a small influence in the transformation of a dead body. The action of this medium depends upon the greater or less exactness with which it excludes the access of air and water. Thus sandy soils which quickly absorb water, and argillaceous soils which collect water round a dead body, differ materially in their effects; in the former decomposition goes on slowly, and is sometimes, as we have seen, altogether prevented; in the latter putrefaction readily takes place, and sometimes the transformation into adipocire is effected. Fresh ground or gardens which are rich in mould, and the soil of church-yards, appear to act as a sort of ferment which assists putrefaction; for it is found that flesh enters sooner into the putrefactive process when surrounded by substances already undergoing that change.

We have alluded to the formation of adipocire, and it is necessary, before we leave this part of our subject, to make a few observations on this curious phenomenon. Adipocire, so termed from its resemblance to fat and wax, is a peculiar substance of a soft ductile nature and whitish colour, produced by dead animal substances undergoing decomposition under particular circumstances. We are indebted to Fourcroy for the first scientific account of this peculiar transformation. His attention was directed to it on the occasion of the celebrated exhumations practised at the ancient burying-place *Des Innocens* at Paris, in the years 1785, 86, 87, when from fifteen to twenty thousand bodies were removed for the purpose of eradicating this cemetery. This spot differed from common burying-grounds, where each individual body is surrounded by a portion of the soil. It was the burying-ground of a large district, wherein successive generations of the inhabitants had been deposited for upwards of three centuries. The remains of the human bodies immersed in this mass of putrescence were found in three different states, according to the time they had been buried, the place they occupied, and their relative situations with regard to each other. The most ancient were simply portions of bones irregularly dispersed in the soil, which had been frequently disturbed. A second state, in certain bodies which had always been insulated, exhibited the skin, the muscles, the ten dons, and aponeuroses, dry, brittle, hard, more or less grey, and similar to what are called mummies in certain caverns. The third and most singular state of these soft parts was observed in the bodies which filled the common graves or repositories. These were cavities thirty feet in depth, and twenty on each side appropriated to contain the bodies of the poor. Each cavity contained between 1000 and 1500, packed side by side in rows, without any intervening earth; so that it might be considered, when filled, as an entire mass of human bodies separated only by two planks of about half an inch thick. The first of these receptacles opened in the presence of Fourcroy had been closed for fifteen years, the coffins were in good preservation, but a little settled, and the wood had a yellow tinge. When the covers of several were taken off, the bodies were observed at the bottom, leaving a considerable distance between their surface and the cover, and flattened as if they had suffered a strong compression. The linen which had covered them was slightly adherent to the bodies, and with the form of the different regions, exhibited, on removing the linen, nothing but irregular masses of a soft ductile matter of a grey-white colour. These masses environed the bones on all sides, which had no solidity, but broke by any sudden pressure. The appearance of this matter, its obvious composition and its softness, resembled common white cheese; and the resemblance was more striking from the prints which the threads of the linen had made upon its surface. The grave-diggers asserted that they never found this matter in bodies interred alone; but that the accumulated bodies of the common graves only were subject to this change. Fourcroy remarked that the conversion appeared in different stages of advancement, so that in various bodies the fibrous texture and colour, more or less red, were discernible within the fatty matter; that the masses covering the bones were entirely of the same nature, offering indistinctly in all the regions a grey substance, for the most part soft and ductile, sometimes dry, always easily separated in porous fragments, penetrated with cavities, and no longer exhibiting any traces of membranes, muscles, tendons, vessels, or nerves. By examining this substance in the different regions of the body, it was found that the skin is particularly disposed to this remarkable alteration. It was afterwards perceived that the ligaments and tendons no longer existed, or at least had lost their tenacity, so that the bones were entirely unsupported, and left to the action of their own weight. In all the bodies so changed, the abdominal cavity had disappeared. The integuments and muscles of this region being converted into the white matter, like the other soft parts, had subsided upon the vertebral column, and were so flattened as to leave no place for the viscera; and accordingly there was scarcely ever any trace of them observed in the almost obliterated cavity. The thorax was also flattened, and its viscera were no longer discernible. Sometimes an irregularly rounded mass was found, which appeared to have arisen from the fat and fibrous substance of the heart. The features of the face were converted into adipocire, and no longer distinguishable, and some of the same matter occupied the cavities of the mouth and orbits. The cranium constantly contained the brain, changed into a similar substance. From various observations, it was found that this fatty matter was capable of enduring in these burying-places for thirty or forty years, and is at length corroded, and carried off by the aqueous putrid humidity which there abounds.

Adipocire, according to M. Chevreul, consists of margaric acid, oleic acid, a little bitter substance, of an orange-coloured principle which tinges the acid, of a trace of odorous principle, of ammonia, very small quantities of lime and potass, and some salts. The alkalies we have mentioned partly saturate the margaric and oleic acids. The latter exists in a very small proportion relatively to the margaric, which abounds in this substance. It is easy to perceive from this analysis that adipocire is a soap with double acid and ammoniacal base. Sometimes, however, the acids are found combined with lime. This has been observed when bodies undergo the change in water containing carbonate or sulphate of lime; and also in earth permitting the infiltration of water which has dissolved these salts in its progress through it. In both cases the ammoniacal soap is first formed, and is then decomposed by the calcareous solution; margarate and oleate of lime, and carbonate or sulphate of ammonia being the result. To prove that such is the case, the following experiments were made by Orfila and Leseur.

On the 4th of December, 1828, they interred a stomach, a portion of skin with the subjacent cellular tissue, two testicles, and an omentum, all belonging to the human subject. Each of them was enveloped in linen, and placed in a small deal box, which was buried at a depth of two feet and a half. They were disinterred on the 30th of July, 1829, seven months and twenty-seven days after having been deposited in the ground. In place of the stomach they found about half a drachm of adipocire not in the least ammoniacal, but composed of margaric and oleic acids and lime. The skin presented here and there the appearance of adipocire, and furnished on analysis a calcareous soap; the testicles were similarly transformed. The omentum had preserved its aspect and structure in several places, whilst in others it was changed into a yellowish fatty mass, having the odour of Roquefort cheese, and composed of lime and the acids mentioned above. These distinguished experimenters, although pretty certain that the presence of the calcareous soap at the expense of the ammoniacal, in these substances, was owing to the rain-water in filtering through the ground having dissolved some of the calcareous salts, which having thus got access to the interior of the wooden box, decomposed the ammoniacal soap, and changed it into calcareous, nevertheless thought it necessary to prove by direct experiment that it really was so. Accordingly they prepared an ammoniacal soap with pure stearic acid and caustic ammonia, and plunged it into a solution of sulphate of lime. At the end of three weeks, on examining the soap, it was found entirely changed into stearate of lime, and sulphate of ammonia was formed. They made also another experiment: two human stomachs were buried, one in a leaden box enclosed in a wooden one, the other in wood alone: seven months afterwards they were taken up. The stomach contained in the wooden box was transformed into a soap partly ammoniacal but chiefly calcareous, whilst that enclosed in the lead offered no trace of saponification, and was but little altered.

"It is manifest," say they, "that, in this last experiment, the progress of the putrefactive process had been greatly retarded in consequence of the double envelope, and particularly of the leaden cases; and every thing leads to the conclusion, that if the apparatus had remained under ground as long as was requisite for converting the stomach into soap, this soap would have been of the ammoniacal and not of the calcareous kind." (Traité des Exhumations Juridiques, tom. i. p. 366.)

Adipocire is only formed when fat and some azotized substance are found together. The fatty matter furnishes the margaric and oleic acids, and the other the ammonia. This is proved by the following circumstances. Entire dead bodies, or entire parts of a dead body, such as a head, one of the limbs, or the thorax, parts in which are found skin, fat, muscles, &c. are changed into adipocire in stagnant or gently moving water, but isolated muscle furnishes but a small portion of this substance, and that only when it is rich in fat. Fat washed, freed from blood, and separated from parts which contain azote, is not transformed into adipocire. Neither does the fibrine of the blood, when perfectly washed and free from fat, undergo the change. Orfila found that portions of skin previously deprived of the subjacent cellular tissue, were not saponified after eight months of inhumation; while similar portions of the skin of the same individual, to which the cellular substance was left adhering, and buried during the same time, were converted into adipocire. It appears that a sojourn of about three years in the ground is necessary for the complete transformation of a body, and that the change goes forward more quickly in water; and it is only when a number of bodies are buried in the same grave, that the process is perfect, those at the bottom being the first to undergo it. A thick stratum of earth over the grave is necessary, in order to confine the gases given out in the first stages of putrefaction.

[A medico-legal question has arisen respecting the length of time which a body must remain in water, in order that this transformation of the tissues may take place. (See the writer's *Human Physiology*, 5th edit. i. Philad. 1844.) Dr. Gibbs found, that by macerating muscle in water for about a month, he was only able to obtain a small quantity of adipocire. Dr. Harlan observed, that the integuments of a cranium were, by maceration, converted into it in about six weeks; but in some experiments instituted by Mr. Taylor, (*Manual of Med. Jurisprudence*, p. 515: Lond. 1844,) the conversion of muscle and fat to adipocire was not complete in stagnant water under two months.]

The chief object of the medical jurist to whom a dead body is submitted for inspection, is to ascertain the cause of dissolution. In order to assist in this investigation, we will follow the arrangement already proposed.

I. Death from Natural Causes.—Death is the inevitable condition to which all bodies that possess life must, sooner or later, be reduced. This termination of their existence forms a grand distinction between organized and unorganized matter. The gradual termination of life, or natural death strictly so called, is very different in its phenomena from the more common or accidental death. In natural death man expires, as it were, in detail; the external functions and those of the animal life being almost annihilated, whilst those of organic life still remain in vigour. The active powers gradually desert each organ; digestion languishes; secretion, absorption, and capillary circulation are arrested; the general circulation is then suspended in the large vessels; and lastly, the contractions of the heart cease. In accidental death, the general circulation and respiration are first arrested, while the other functions are successively and slowly extinguished. So that it has been said that in the former life is first extinguished in the parts, and then ceases in the heart, the influence of death being exerted, as it were, from the circumference to the centre; while in the latter it ceases first in the heart, and then in all the parts, death proceeding from the centre to the circumference. The termination of life termed natural death is a very rare occurrence in the human species in a civilized state: animals often reach it; but the cessation of existence from mere old age has become with us a rare phenomenon. Haller estimates the average probability of human life, and deduces the conclusion that only one individual in fifteen thousand reaches the hundredth year. Accidental death, in contradistinction to natural death, becomes, therefore, an object particularly worthy of attention. This may take place in two ways—either as the slow and gradual termination of a lingering disease; or as the sudden result of some great disturbance of the animal economy, and then called sudden death, as in apoplexy, hemorrhage, concussion, asphyxia, &c.

We now come to consider the natural causes of sudden death, and our observations upon them must be necessarily brief, as it would not be possible to enter into detail upon them in this place; a circumstance not of much consequence, as they are most of them treated of in separate articles through this work. However, we may notice some of the most frequent and remarkable. These are apoplexy, rupture of an aneurism or of a large vessel into one of the cavities; bursting of purulent cysts or other collections of fluid, or of blood-vessels into the air-passages; ossification of the valves of the heart; rupture of this organ; asphyxia idiopathica.

Apoplexy may attack at any age, but in the great majority of cases the age is above fifty years: certainly it may be said to be a disease rather of the decline of life. It is a disease which in some instances may be mistaken in its early symptoms, and may terminate fatally in situations which preclude any observation of the event. Those most predisposed are of a full plethoric system, with large head and short neck. Diseases of the blood-vessels of the brain, such as ossification of the arteries, aneurism, and obstruction of the sinuses, lead to rupture of their coats; and it is well known that hypertrophy of the heart sometimes produces apoplexy. In ordinary cases an examination of the brain sufficiently developes the complaint. Blood is usually found in some part of this organ, rarely on the surface, more commonly in or about the corpora striata or optic thalami, or effused into the ventricles. In old apoplectics who have had many shocks, cysts enclosing clots of blood are found; and the brain surrounding them is often observed in different stages of inflammation or ramollissement. (See Apoplexy.) It should be borne in mind that persons seized with apoplexy may fall from a height, and thus bear marks of external injury which might mislead a superficial inquirer as to the cause of death. In cases of rupture of internal aneurisms, or purulent cysts, or of ossification of the valves of the heart, an examination of the body will exhibit the true nature of the disease. The last of the natural causes of sudden death which we have mentioned is that peculiar disease termed by Mr. Chevallier "asphyxia idiopathica." A case of this rare and remarkable affection came under the observation of the writer a few years ago. The subject of it was a healthy woman, forty years of age, in the ninth month of pregnancy. She complained suddenly one evening of weakness and sickness of stomach, and on making an effort to vomit, she fell back and expired without any struggle. The writer examined the body the following day, and inquired diligently after every cause of death in each of the cavities; but he never saw more healthy organs, and, taken altogether, certainly never a sounder body. But the state in which the heart was found led to a discovery of the nature of the case. The parietes of this organ were entire, but quite flaccid, and all its cavities were empty; while its proper veins were much distended with blood. This so exactly resembled the appearances described by Mr. Chevallier, and the manner of death corresponded so fully with that of the cases he mentions, that it was thought justifiable to refer the cause of death to the disease just alluded to. Mr. Chevallier accounts for death in these cases by supposing a sudden loss of power in the vessels, chiefly in the minute ones, to return the blood to the heart; in consequence of which this organ, after having contracted so as to empty itself, and then relaxing, continues in that state for want of its accustomed stimulus, and so dies. We mention this in order to show that such cases are sometimes to be met with, and that it is necessary to be prepared to detect them. For further information we must refer to the paper alluded to.

II. Death from Violent Causes.—The wide extent of this division, and the great importance of the topics included in it, render it of the deepest interest to the medical jurist. The violent causes of sudden death may be reduced to seven heads, viz. *asphyxia*, *poisoning*, *wounds*, *burning*, *cold*, *starvation*, and *lightning*. From the very able manner in which the subject of asphyxia has been handled in a former part of this work, little remains to be said upon its general phenomena and theory. (See Asphyxia.) Asphyxia may be defined the suspension of the function of respiration, and consequently of the circulatory and cerebral functions. The interruption may affect primarily either the mechanical or chemical phenomena of expiration. The mechanical are the motions of the parietes of the chest, producing inspiration and expiration; the chemical are the disappearance of oxygen from the air taken into the lungs, the disengagement of carbonic acid gas, and the conversion of the venous into arterial blood. Asphyxia may commence by the cessation of either of these classes of phenomena; but in whichever it first begins, it speedily involves the other, and both are soon equally suspended. A violent compression of the thorax, such as is produced by the falling of heavy beams of timber, portions of buildings, roofs of mines, &c. a double wound giving entrance to the air into both cavities of the chest, rupture of the diaphragm by which the abdominal viscera gain admission to the chest, the effusion of large quantities of fluid into the pleura,—all these put an end to the mechanical phenomena of respiration by interrupting the motions of the thorax. In other cases these motions cease, but from a different cause; we allude to paralysis of the muscles that move the parietes, which happens when the spinal marrow is cut across, or is pressed on above the origins of the phrenic nerve, or above the third cervical vertebra, or when the whole nervous energy is destroyed, as by lightning. Most commonly, however, it is the second class, or the chemical phenomena of respiration, that cease first; and the motions of the chest are only interrupted because the black blood, which is then driven into all the organs and especially into the muscles and brain, does not carry along with it the power of excitation necessary to carry on the functions of these parts. This interruption of the chemical phenomena may be produced in various ways: thus sometimes there is total interception of the passage of air into the lungs, as when an animal is placed in vacuo, or is smothered, drowned, or strangled; at other times, an aeriform fluid does enter these organs, but is not possessed of the principle necessary to act on the blood contained in them, such as azote and hydrogen gases. It may be that the gas inhaled is endowed with deleterious properties; either that it irritates the lungs, as the sulphuric acid gas, muriatic acid, and ammoniacal gases; or that it acts upon the whole animal economy as a poison, such as carbonic acid gas, nitrous acid, carburetted hydrogen and hydro-sulphuretted gases. Thus we find that, by the total interception of all air, or by the inhalation of noxious gases, the chemical phenomena of respiration may be arrested. It is to this we shall direct our attention at present, as the cases in which the mechanical phenomena are first affected are more rare, and will be afterwards considered in treating of death from wounds or bruises, and from lightning.

The causes that produce death by asphyxia are drowning, hanging, and strangulation, smothering, and the inhalation of noxious gases or air deprived of oxygen.

The physiology of **Drowning** having been already fully discussed in the article Asphyxia, we shall proceed to consider the medico-legal questions that may arise in the case of a body found in water. These may be arranged under the following heads:—1. whether the body was immersed before or after death; 2. whether the individual has fallen in by accident, has drowned himself, or has been thrown in by others.

1. The inference that the person was living at the time of immersion is drawn from an attentive examination of the external state of the body, and from a careful anatomical investigation. The body of a drowned person usually presents the following appearances. It is commonly very cold, apparently even colder than the actual temperature; the limbs are more or less stiff according to the time that has elapsed since death; the visage is swollen, often dark-coloured, but sometimes pale; the eyes are half open and the pupils dilated; the mouth is filled with froth; the tongue is advanced beyond the teeth; and the chest and belly are elevated, the latter being often much distended. This state of the body is common to those who perish in cold clear water, as the sea, rivers, &c.; but the body is sometimes drawn out warm, although death is so complete that animation cannot be restored, the countenance violet-coloured, and the veins of the neck turgid. This happens in drowning in warm fluids or in alcoholic liquids, or in marshes where deleterious gases are disengaged, or when the person has fallen into the water in a state of intoxication. The ends of the fingers are often found rubbed or scraped, and dirt or sand, of a nature similar to that of the bottom of the water, is perceived under the nails. Coupled with these is the negative sign furnished by the absence of any lesion that could have caused death previous to submersion. The internal appearances disclosed on opening a drowned body are generally the following. The epiglottis is found elevated, and a quantity of

froth fills the trachea and bronchi; the lungs are dilated and gorged with blood; black and fluid blood is found in the right cavities of the heart in a much greater quantity than in the left. The diaphragm is depressed, and water of a nature similar to that in which death took place is discovered in the stomach. In the head there is turgescence of the blood-vessels, more or less intense as the death has been more or less speedy, and in proportion to the amount of struggling made by the individual. Orfila, (Archives Gén. de Méd. Août, 1827,) in a memoir read at the Academy of Medicine, has reviewed all the signs given by authors for determining whether immersion took place before or after death; and the conclusion he draws is, that there is no certain sign of submersion during life but the presence of water, similar to that in which it is found, in the stomach and air-passages; provided that, with reference to the stomach, the water has not been swallowed before submersion, and has not been injected after death: and with respect to the lungs, that the water shall have penetrated to the last uronchial ramifications, and has not been injected before death; and that the body shall not have remained long in a vertical position in the water, so that the water might have entered after death. It would appear from this that we possess two certain signs of submersion during life; but the restrictions imposed on them are such, that, taken apart from others, they are almost useless in the great majority of cases. In speaking of water in the air-passages, Orfila must have meant the froth formed by this fluid with the air; for it is very seldom found in substance in this situation. Devergie (Annales d'Hygiène et de Méd. Lég. t. ii. p. 432; [and Médecine Légale, 2d edit. ii. 392: Paris, 1840] states that in a great number of cases he could find but very slight traces of water in the trachea; and in two only did he observe it in any quantity. Indeed, from the observations of Cullen, (Letter to Lord Cathcart,) Goodwyn, (Connection of Life with Respiration,) and Meyer, (Medical Repository, vol. iii. New Series,) it is plain that a very small quantity of water enters the air-passages in drowning; and this is speedily converted into froth by the motion given to it in the attempt at respiration. On the subject of this froth, Devergie makes some interesting observations, the substance of which is as follows:—It is commonly white, consisting of numerous and very small bubbles, constituting a lather rather than a froth properly so called. It never adheres to the trachea by mucus, but is in immediate contact with that tube. All the bubbles that form it have a watery envelope, easily broken, and often on opening the trachea the greater part disappear like soap-bubbles. The froth of drowned persons, then, has but little analogy with the expectoration of pneumonia or catarrh; and it is sufficient to have attentively observed it to avoid confounding them. Its formation necessarily brings with it the idea of vitality, for it cannot take place without motion, an impulse communicated to a fluid and a gas in mutual contact.

In order to appreciate its mode of formation, and the value that it may possess as a sign of submersion during life, it appears necessary to inquire how it is produced in other cases than asphyxia by submersion. In pneumonia, for example, the individual is induced to expectorate because the extreme bronchial ramifications are filled with mucus, and the air can no longer reach them, and come into contact with the blood to effect the necessary changes. The invalid expels a frothy matter, because the mucus secreted under the influence of bronchial irritation is beaten and mixed up with the air by the alternate and quick efforts of inspiration and expiration, which constitute coughing. The formation of the froth takes place more easily as the irritation is nearer to the last bronchial ramifications, when the tubes, being of a smaller diameter, are more easily obstructed. It is, on the contrary, produced with great difficulty in the trachea, on account of the great dimension of this canal. In drowned persons similar phenomena take place, after they have expelled a part of the air contained in their lungs. They are soon solicited by the desire to respire; a small quantity of water enters the trachea, and causes a most distressing stimulus, of which we have a proof in the great suffering experienced by persons into whose larynx a drop of fluid has accidentally fallen while swallowing; a brisk and sudden expulsion of the water is effected, but it is rarely complete: the portion which remains dissolves a little mucus, and becomes viscid, whilst, at the same time, new inspiratory efforts draw in a new quantity of water: from that time the air, agitated with this fluid, rendered more viscid, constitutes the froth. This is formed with more difficulty in the trachea than in the last ramifications of the bronchi; and consequently we esteem its existence in the superior part of the trachea as a more certain sign of the life of the individual at the moment of submersion than when it is met in the extreme branches. This phenomenon does not leave very durable traces of its existence, for it is sensibly diminished, and even often disappears under the influence of putrefaction. The portion of the air-passages where it is preserved during the longest period is at the bifurcation of the trachea. In winter it may be discovered in most cases after eight or ten days; but later it completely disappears. It is true, that if we except the water contained in the stomach, the other signs of submersion have not a more extended duration. It should be understood that the water thus taken into the lungs is not, as it was formerly supposed, the true cause of death; an opinion to which Baron Larrey seems to incline in his Mémoires. The experiments of Goodwyn have shown that a much larger quantity of water than that which is found in the lungs of drowned animals, may be introduced into the air-passages without causing death. Thus, he passed into the lungs of a cat, through an opening in the trachea, two ounces of water; a large quantity when compared with the size of the animal. It had, immediately, difficulty of breathing and a feeble pulse; but these symptoms soon abated, and it lived several hours afterwards without much apparent inconvenience: after this he strangled it, and found two ounces and a half of fluid in the air-tubes and cells.

The presence of water, then, in the lungs of drowned persons in the form of froth is to be considered as an accidental and not essential circumstance, although it is one of very constant occurrence. If this fluid is found in large quantity, and in substance, that is, not beaten into froth, the inference would be that it had passed in after death. With respect to the presence of water in the stomach, it has been proved by many authors to be a constant occurrence; and when it is discovered in this organ, and is identical with that in which the body is found, it furnishes a strong indication of submersion during life, being a necessary consequence of the act of deglutition. For it has been proved by Fine, Orfila, and Marc, that it is never found in bodies plunged into water after death, and cannot be made to enter the stomach without the assistance of a tube passed into the œsophagus.

[A circumstance, which influences materially the quantity of water contained in the stomach, is the depth of water in which the individual was drowned. This is shown by some experiments instituted by Mr. Taylor. (*Elements of Medical Jurisprudence*, p. 121.) A cat was lowered to the depth of 55 feet in the Thames; another was held two feet below the surface. The stomach of the first cat contained a large quantity of water; that of the second scarcely any. A third cat was permitted to rise repeatedly to the surface. The stomach of this cat was distended, but not so much as the one that had been lowered to the depth of fifty-five feet. The influence of pressure of water is, therefore, considerable; and as has been remarked by Dr. Guy (*Principles of Forensic Medicine*, Part 2, p. 317: Lond. 1843,) it is probable, that where the water is very deep, the pressure of the fluid may overcome the resistance offered by the collapse of the œsophagus, even although the animal died previously to submersion.

It is proper to remark, that where water has entered the stomach, it may not be found there after death. If the head be permitted to hang down lower than the stomach, the water will run out. Two cats were drowned in nine fathoms of water. After having remained at this depth for half an hour, they were removed, and suspended with the head downwards. Water drained freely from them, and on examination of the bodies three days afterwards, none was discovered in the stomach or alimentary tube. (Taylor, *op. cit.*)]

From the above-mentioned circumstances the following conclusions are drawn by Devergie: 1. that almost all the signs, taken singly, do not prove that the individual was living at the moment of immersion; 2. that the one which furnishes the strongest presumption is the existence of froth placed in immediate contact with the lining membrane of a sound trachea; 3. that this sign acquires a value greater as its situation is nearer to the mouth; 4. that water in the air-passages is a sign of little value, for if it can penetrate the trachea after death, and extend even to the last bronchial ramifications, as Orfila has shown, it becomes almost useless; 5. that water in the stomach is one of the most constant signs, but its value is greatly diminished by the difficulty of proving its identity with the fluid in which the body has been immersed; 6. that if each sign taken singly gives no certainty, the assemblage of all in the same individual may enable a positive conclusion to be drawn.

The proofs that death occurred before immersion are drawn from the absence of all those signs just enumerated; thus the thorax and abdomen will be found flat,—no excoriation of the ends of the fingers,—no dirt or sand under the nails,—no turgescence of the cerebral vessels,—and no froth in the air-passages. The lungs will be collapsed, and the diaphragm will not have passed the natural line. The stomach will be found not to contain any of the fluid in which the body is found, and in addition to these negative proofs, marks of violence may be discovered on the body quite sufficient to account for death. These marks are divided by Fodéré, (Méd. Lég. tom. iii. p. 112,) into three classes: 1st. those which are totally independent of any connexion with the circumstances of drowning. Of this nature are the usual signs of poisoning; a regularly formed ecchymosis round the neck, indicative of strangulation, or wounds inflicted by fire-arms or cutting instruments. All these lesions have an essentially distinct character which cannot be mistaken, and hence the evident importance of examining carefully the external appearance of all bodies found in water. It was by pursuing such an investigation that Deveaux discovered, in the body of a woman found in water, a penetrating wound under the left breast, made by a very small instrument which had reached her heart. 2dly. Marks of violence which may have resulted from accidents attending submersion, or may be caused by previous homicide, such as unequal irregular wounds which do not penetrate far into the body, contusions, fractures, and luxations. In all such cases we should ascertain, if possible, the height from which the individual may have fallen, and the resistance he may have encountered in the fall. The rapidity of the current, and the roughness of the banks of a river may also cause extensive wounds. Dr. Fine remarks that the rapidity of the Rhone, and the numerous mills erected on its side, often produce most shocking wounds in the bodies which are driven against the stakes in the stream, or are drawn into the machinery. 3dly. There may be lesions received after death. These are to be distinguished from those inflicted during life by the lividity and flaccidity of their edges, the absence of tumefaction and redness, and want of hemorrhage, or, if the latter be present, by the fluidity of the blood.

2. It being ascertained that the subject was immersed while living, it is often of importance to be able to say whether the drowning was the result of accident, of suicide, or of homicide. The solution of these questions is to be obtained by an examination of what may be termed the external circumstances of the case. The locality of the water may be such as to account for the deceased having accidentally fallen into it, or its situation may at once preclude the possibility of such an event. Indications of struggling on the brink, such as tearing of the ground, and many footsteps, together with ecchymoses on the person of the deceased, may lead to the supposition of homicide. Thus, in the case of Mr. Taylor, who was murdered at Hornsey in December 1818, marks of footsteps deep in the ground were discovered near

the New River; and on taking out the body, the hands were found clenched, and contained grass which he had torn from the bank. (*Paris and Fonblanque*, Med. Jur. v. iii. p. 41.)

However conclusive the existence of ligatures on the hands and feet of the deceased may appear,—as to the question of the forcible interference of others, it should be recollected that suicides have sometimes adopted such precautions in order to insure their death. There are some instances on record, in which the individuals seem to have pursued this course. (Op. cit.) In June 1816, the body of a gauging-instrument maker, who had been missing for some days from his home, was discovered floating down the Thames. On being taken out, the wrists were found tied together and made fast to his knees, which were in like manner secured to each other. He had been in a state of mental derangement for two years. The cord with which he had tied himself was recognised as one that had hung from the ceiling over his bed, by which he used to raise himself up, as he had been confined to bed for some weeks. He was a good swimmer, and it was presumed he had taken this precaution to prevent himself from employing that power. The verdict returned was, "found drowned." The other instance was that of a man, aged twenty-eight, who with a wife and child was reduced to great distress. On a certain day he took an affectionate leave of his family, declaring he would not return until he had procured some employment by which he should be able to buy bread for them. The following day his body was taken out of the New River with his hands and legs tied. A card with his address was found in his pocket, and also three-pence; when he left home he had five-pence, and it was supposed he had purchased the cord with the deficient sum; the verdict brought in was "insanity." Another case of a similar nature has been lately published. It was that of a gentleman who was found in the Seine at Paris, having his feet, wrists, and neck tied with a cord. After detailing the appearances of the body, the reporter concludes with the following note: "Mr. X—— had bound his neck, limbs, and hands by means of a rope with slip knots, in order to put it out of his power to aid himself when in the water, and thereby to render certain the execution of his suicide." (Ann. de Hygiène et de Méd. Lég. t. ix. p. 207. [See, also, his Médecine Légale: Paris, 1840.]) We mention these cases to show how cautious a medical man should be in forming an opinion in similar instances, and how necessary it is to weigh well every circumstance before he expresses that opinion before a legal tribunal.

It is often, as has been already mentioned, of the highest importance to the survivors, that an approximation to the time that has elapsed since death should be arrived at. For assistance in such an investigation, the medical jurist will turn in vain to the systematic works on legal medicine, it being only within the last few years that any accurate information on the subject was possessed by the profession. We are indebted to M. Devergie for the first essay on this interesting subject, one concerning which the most vague notions were entertained previously to the publication of the memoir alluded to, in the year 1829. The observations of M. Devergie are entitled to much consideration, from the unrivalled opportunity afforded for their formation. He was authorized to carry on his investigations at the establishment called "La Morgue" in Paris, a building on the banks of the Seine, to which are transported all bodies found dead in the city and its environs, and where they are exposed during three days for the purpose of recognition by their friends. The number thus exhibited exceeds three hundred annually, and includes all manner of violent deaths. In case of the sudden disappearance of an individual, his friends repair to the Morgue, and leave with the porter an accurate description of his person, his clothes, and the period at which he was last seen; and when a body is brought in, it is carefully examined, and if it corresponds with any of the descriptions that have been left, notice to that effect is sent to the persons interested, who come and claim it. The number of persons recognised is very considerable; in the first six months of the year 1829, out of 148 bodies 116 were claimed. Of this number 62 were drowned, of whom 45 were recognised. Being thus furnished with positive information as to the time of immersion and that of finding the body, Devergie was enabled to prosecute his inquiries with great accuracy. He found that in general no change takes place on the exterior before the fourth or fifth day, and the cadaverous rigidity frequently continues two, three, or even four days after immersion. This is probably owing to the coldness of the medium in which the body is placed. About the fourth or fifth day, the skin on the palms of the hands begins to whiten, and this change of colour takes place particularly on the ball of the thumb, and the fleshy eminence on the inner side of the palm over the metacarpal bone of the little finger, together with the lateral surfaces of the fingers. The back of the hand does not partake of this colouring, and the rest of the body presents nothing particular. On the sixth or eighth day, the skin at the back of the hand begins to whiten; at the same time that the sole of the foot has acquired a similar tinge: the skin of the face is softened, and of a more faded white than the rest of the body. On the fifteenth day, the face is slightly swollen and red; a greenish spot begins to form on the skin over the middle of the sternum; the hands and feet, with the exception of the dorsum of the latter, are quite white, and the skin of the palm of the hand is wrinkled. The subcutaneous cellular tissue of the thorax is reddish, and the cortical substance of the brain takes on a green colour in the upper part of that organ. At one month, the face is reddish brown, the eyelids and lips are green and swollen, the neck is slightly green, and a spot of about six inches in diameter, brown in colour and with a green areola, occupies the superior and middle part of the sternum. The scrotum and penis are enormously distended by gas, the latter being sometimes in a state of erection from that cause. The skin of the hands and feet is quite white and very much wrinkled, presenting the appearance of having been long enveloped in a poultice. The hair and nails are still very adherent. The lungs are emphysematous, and fill the cavity of the chest overlapping the heart,—a condition different from that which these organs present at a more advanced period. At a month and a half, besides the appearances first mentioned, the neck and thorax are found very green, and the cuticle begins to detach itself round the base of the hand where it joins the wrist. At two months, the body is covered with slime, which penetrates through the clothes. The face is enormously swelled and of a brown colour, the lips are tumefied and separated so as to expose the teeth. The skin on the middle of the abdomen, as well as that of the arms, forearms, thighs, and legs, is still in a natural state. This is a most remarkable fact, and establishes a striking difference between the progress of putrefaction in water, and when the body is exposed to the atmosphere; in the latter case, the abdomen being the first part to manifest any change. At this period the skin has become detached from the hands and feet, and having the nails attached to it, forms as it were a glove. The skin and nails of the feet are longer in separating than those of the hand. The hair begins to fall off, and is easily removed by pulling. The veins are almost completely empty of blood and commonly distended with gas. The inner surface of the arteries is red, and that of the trachea between the cartilages presents the same colour. If at the moment of death the right cavities of the heart were gorged with blood, the internal surface of the ventricle is of a jet black colour; and in contrary cases an analogous appearance is presented on the opposite side. Devergie considers this a most important diagnostic mark of death by asphyxia. At two months and a half, the green colour of the skin extends to the arms, forearms, and legs; the nails are completely detached from the hands and feet; some adipocire is formed on the cheeks, chin, breasts, arm-pits, and anterior part of the thighs: the abdomen is greatly swollen by putrefaction within; the muscles at this period preserve their natural colour, and do not appear altered in texture. At three months and a half, there is observed destruction of the scalp, eye-lids, and nose, to such an extent as to make it difficult to tell the age of the individual. The skin of the breast is generally of a greenish brown; the centre of the abdomen is of an opaline colour, and scattered with small ulcerations caused by the water. Larger corrosions are found in different parts of the body. The hands and feet are completely naked of skin. The lungs no longer fill the thorax, but leave between them and the pleura costalis a space filled with reddish serum. At four months and a half, occurs complete destruction of the face and scalp, leaving the skull bare; the remains of face, the neck, and anterior part of the thighs is entirely converted into adipocire; and small eminences, indicating the commencement of calcareous incrustation, are observed on the prominent parts. The brain presents traces of adipocire in its anterior part. Devergie has not classified the changes that take place at more advanced periods. The period from which we have extracted the foregoing account has been severely criticised by Orfila, (Traité des Exhumations Juridiques, t. ii. p. 83,) who endeavours to overturn the facts and doctrine contained in it. But we think he has been satisfactorily and triumphantly replied to by Devergie, (Annales d'Hygiène pub. et de Méd. Lég. t. v. p. 429, [and Med. Légale, i. 229,)] who adduces as the best proof of the validity of his conclusions, four cases, in which the periods of immersion, varying from fifteen days to one, two, and eight months, were ascertained with the help of his table.

As the physiological phenomena observed in persons dead from **hanging** and **strangulation** are nearly the same, we shall consider them together in the present section, pointing out the differences between them as we proceed.

Notwithstanding the authorities of Boerhaave, Morgagni, and Portal, who imagined that apoplexy was the immediate cause of death in hanging, it is now generally admitted that the event is owing to suffocation. This opinion is confirmed by the experiments of Gregory and Brodie, from which it appears that if an artificial opening be made into the trachea of an animal, below the ligature by which it is suspended, it will continue to live. But we must admit that other injuries are sometimes inflicted, of themselves sufficient to account for death, such as compression of the nerves of the neck, and fracture or dislocation of the spine. With respect to the former, Dr. Paris remarks: "Although the pressure of a ligature on the nerves of the neck cannot be considered as the immediate cause of death in hanging, yet Mr. Brodie has very justly observed that if the animal recovers of the direct consequence of the strangulation, he may probably suffer from the effects of the ligature upon the nerves afterwards. Mr. Brodie passed a ligature under the trachea of a guinea-pig, and tied it tight on the back of the neck with a knot: the animal was uneasy, but nevertheless breathed and moved about. At the end of fifteen minutes the ligature was removed; on the following morning, however, it was found dead. On dissection no preternatural appearances were discovered in the brain, but the lungs were dark and turgid with blood, and presented an appearance similar to that which is observed after the division of the nerves of the eighth pair. 'I do not,' observes Mr. [Sir B.] Brodie (manuscript notes), 'positively conclude from this experiment that the animal died from an injury to the eighth pair, but I think that such a conclusion is highly probable; and it becomes an object of inquiry whether a patient, having recovered from hanging, may not in some instances die afterwards from the injury of the par vagum.'" (*Paris and Fonblanque*, Med. Jur. v. ii. p. 44.) Fracture or dislocation of the spine, when they do take place, must of course contribute to the speedy death of the individual; but these accidents are very rare, even when the fall is great, as in public executions. In numerous instances that have come under the observation of the writer, this cause of death was never observed. As in the case of drowning, two questions present themselves for solution by the medical witness: 1. whether the individual was suspended before or after death; 2. whether it was an act of suicide or of murder. An individual found suspended may have been killed in different ways; first, he may be hung up after having been murdered; and again, he may have committed suicide by hanging after having previously tried to destroy himself by other methods, in which he has failed, as by fire-arms cutting the throat, &c. In the first case we might be led to mistake murder for suicide, and in the second suicide for assassination. It is necessary, then, to be aware of the signs by means of which death by strangulation in general may be distinguished, in whatsoever manner it may happen. These are lividity and distortion of the countenance, protrusion of the eyes, which are frequently suffused with blood, projection and wounding of the tongue by the teeth. The latter depends upon the position of the rope: if it be below the cricoid cartilage, the tongue is pushed out; but if it presses above the thyroid cartilage, it is carried along with the os hyoides backwards. In addition, we have the mark of the cord around the neck forming a livid depressed circle; the fingers usually bent, the nails blue, and the hands nearly closed, with swelling of the chest, shoulders, arms, and hands, and sometimes ecchymoses in these situations; also semi-erection of the penis, and emissio seminis. Cases of death by hanging occasionally present themselves in which the countenance is pale; this arises from the suddenness of death in some individuals, and particularly if the spine be dislocated. On dissection, the body presents nearly the same appearances as those described as caused by drowning, with the exception of water in the air-passages. A bloody mucus issues from the mouth and nose; but this is very different from the froth of drowned persons. The principal vessels of the head and neck are filled with blood, and sometimes ruptured. With respect to the bruised mark of the rope round the neck, it is stated by M. Klein (Journal de Méd. prat. de Hufeland, 1815) to be an uncertain sign, —an opinion founded on fifteen cases of suicide by hanging, in all of which it was wanting. Remer, (Annales de Hygiène pub. et de Méd. Lég. tom. iv. p. 166,) of Breslau has more lately investigated this subject on an extended scale, and out of one hundred cases collected by him, eighty-nine presented the sugillation on the neck in an evident manner. In one case, instead of ecchymosis, the skin was found of a yellowish brown colour, like parchment; in two others the skin was excoriated; in another putrefaction prevented any certain examination; and in nine cases it is expressly mentioned that ecchymosis was wanting. It follows from this, that out of one hundred hanged persons, nearly one-tenth were found without a bruised mark. But if this proportion is sufficiently great to induce medical jurists to withhold unlimited confidence in this sign, it is at the same time too small to destroy the validity of the general rule, that such impressions are found in hanged persons. In all the cases that have come under the observation of the writer, the mark of the rope was most distinct. These were all executed criminals, in whom, from the nature of the ligature and the height of the fall, such impressions might be expected; but even in the most unfavourable circumstances the ecchymosis has been strongly marked. Remer (loc. cit.) mentions that it has taken place notoriously in those found strangled in a position in which either the feet or the knees had not left the ground. In all the instances observed by us, the ecchymosis did not occupy the part of the skin with which the rope was in contact, but formed two lines on either side of it, one above, the other below; while the intervening portion, the part actually compressed by the cord, resembled dark-coloured parchment.

It is quite necessary that the medical jurist should not be content with the discovery of a blue ring on the neck, but that he should cut into it, in order to examine the extent of the extravasations, and the injury done to the parts in its neighbourhood. The height of the fall must cause a difference in the injuries inflicted on the parts composing the neck. When the individual falls from a considerable height, as in public executions, the lesions produced are very extensive. Dr. Houston (Dublin Hosp. Reports, vol. v. p. 317) has published an account of some dissections of criminals in whom the similarity of injury is most remarkable. "Both the individuals were strong plethoric men, executed for murder. Their death was evidently caused by strangulation. The cervical vertebræ were unbroken, and the spinal marrow and brain presented no trace of injury. In both, the sterno-mastoid muscle, on the right side (the opposite to that on which the knot of the rope was applied) was ecchymosed, contused and broken; that of the left side was only slightly bruised. The os hyoides and thyroid cartilage were completely severed from each other. The omo-hyoid, sterno-hyoid and thyro-hyoid muscles, were so bruised and lacerated, that only some stretched shreds of them remained to hold the parts together. The thyro-hyoid membrane was also torn across, and the epiglottis, pulled from its root to the back of the thyroid cartilage, had passed up with the os hyoides and tongue into the back part of the mouth. The skin alone remained unbroken, and interposed between the rope and the cavity of the pharynx. This was the only region of the neck which gave evidence of much injury; the great vessels and nerves all escaped unhurt. In two other criminals, which more lately I have had an opportunity of examining, precisely the same effects had been produced by the rope on the soft parts of the neck, and without any injury to the brain or spinal marrow." The preparations from which the above statement is taken are preserved in the museum of the Royal College of Surgeons, Dublin. The semi-erect condition of the penis, and emission of semen, are signs which, although frequently met with, are not constantly found in hanged persons. Thus Klein, in the memoir alluded to, states he did not perceive them in any of the instances examined by him, and Remer found them only in the proportion of three to four. In some of the cases examined by the writer they were wanting, but in the majority there were evident traces of excitement of the organs of generation. The practice adopted by worn-out libertines, of causing themselves to be half hanged in order to arouse their dormant generative power, is a proof that some effect is produced on these organs by suspension. But as erection is not constantly found in hanged persons, we cannot accord to this phenomenon much value as an indication of death by strangulation, unless when accompanied with other characteristic signs. It adds, then, to the certainty of this kind of death, but it is no proof when it exists alone, for it has been found in other forms of violent death;

and its absence is no proof of the contrary. A remarkable proof of the occurrence of this phenomenon in hanging is given by M. Guyon, (Anderson's Quarterly Journal of the Med. Sciences, vol. ii. p. 151,) surgeon-major at Martinique, who attended the execution of fourteen persons, with a view of ascertaining the truth respecting the disputed subject of emission. Being situated near them at the place of execution, he observed the penis of all become erect at the moment of strangulation, and immediately after five of them made water abundantly. An hour after execution he found in nine of them the penis in a state of semi-erection, and its canal filled with a kind of matter with which the shirt was too profusely impregnated to allow it to be supposed that it came from any other organ than the prostate.

[In some experiments made at Lancaster, Pa., upon the body of a criminal executed there in 1839, it was observed, that there was an ejection of fluid from the urethra, but no erection. This fluid when examined afterwards by the microscope, was found to be mucus, and to contain no spermatic animalcules. (*Amer. Journ. of the Med. Sciences*, May, 1840, p. 26.)]

The second question is, whether it was an act of suicide or of murder. It is admitted by most medical-legal writers that this is a difficult and unlikely method of committing murder, unless the assailants be numerous and powerful. Dr. Smith remarks, "It is perhaps not going too far to say, that a man cannot be hung alive by others, unless his hands be previously tied, and probably his legs also." Accordingly, when a body is discovered hanging, the first impression is usually that the individual has hung himself. But this opinion should not be confirmed until an accurate investigation has been made into all the external circumstances connected with the occurrence. It should first be ascertained that death has been caused by strangulation; for it has happened that crafty murderers have destroyed their victims in some other manner, and then suspended the body in order to create the suspicion of suicide. But supposing strangulation to be recognized, particular attention should be paid to the part of the neck which bears the impression of the ligature, and the kind of mark left by it. Thus, if we find the track of the cord to be low down, and to pass horizontally round the neck, while another and fainter impression exists at the upper part, taking an oblique course, it should excite suspicion that manual strangulation had been resorted to in the first instance, and that the body had been hung up after death. An examination of the dress and person of the deceased will sometimes aid the inquiries of justice by pointing out the signs of resistance and struggling, or robbery. It is necessary, however, to judge of any marks of external violence with great caution, for although they may generally be esteemed proofs of homicide, they may have been purely accidental, or have been inflicted by the individual previous to voluntary suspension. De Haen records the case of a person who, while hanging, inflicted several wounds on his face; and Ballard (p. 409,) mentions a case of suicide, in which the individual first cut his throat partially. The following interesting case is related by Dr. Male. (Juridical Medicine, p. 243.) "An apprentice-boy in my neighbourhood, working alone in an attic, tied one end of a rope loosely round his neck, whilst his master was from home, probably without any intention of destroying himself, and twisted the other round the projecting part of the top of a door, the planks of which were irregular and somewhat divided; a small stool, on which he stood, slipped from under him, when he fell forwards, striking his temple against the corner of a box which cut him to the bone; he lay along the floor, his head and shoulders only elevated a few inches above it; the cord not being tied had run nearly its whole length, and then caught between the planks of the door, in which state he died. The wound was magnified by popular rumour into many, and vengeance was denounced against the innocent master, who was accused of having first killed and afterwards suspended the boy. On examining the boy, the mark of the cord was found to extend from ear to ear; the vessels of the brain were turgid, the thyroid cartilage broken, the nails blue, and the hands firmly closed. From this and other important circumstantial evidence, the coroner's jury were convinced that the charge was unfounded." It should be recollected that a person may be hanged accidentally, and therefore the usual verdicts of insanity, or felo de se, are not to be given in all cases where proofs of homicide do not exist, without due caution. A remarkable instance of this kind is related by Dr. Gordon Smith, (Principles of Forensic Medicine, p. 236,) which occurred in April 1821, in Northamptonshire. A girl, aged thirteen, was swinging in a brewhouse, and near the rope used by her for that purpose was another for the purpose of drawing up slaughtered sheep. In the course of the exercise her head got through a noose of this second cord, which pulled her out of the swing, and kept her suspended at a considerable height until dead.

[Mr. Taylor (*Elements of Medical Jurisprudence*, p. 173,) relates another case. A boy, ten years old, had been amusing himself by fastening a piece of plaid gown to a loop in a cord which was suspended from a beam in the room. In the act of swinging he raised himself up, and gave himself a turn, when the loop of rope suddenly caught him under the chin, and suspended him until life was wholly extinct. A playmate witnessed the occurrence.]

We have said above that it is difficult, without an overwhelming force, to hang an individual against his will; but, on the other hand, it is surprising with what facility death may be accomplished by this means, in situations which at first view would seem to preclude its possibility. The late Prince of Condé, who committed suicide on the 27th of August 1830, was found hanging to a window-shutter, with his feet touching the ground and his knees bent. The attitude in which the body was found raised some suspicion of foul play, and a most accurate investigation of all the circumstances connected with the event was instituted, from which it appeared to have been a case of voluntary suicide. An interesting memoir (Annales de Hyg. pub. et de Méd. Lég. tom. v. p. 156,) on the subject, was published in January 1831, in which are related several instances of self-destruction by hanging, where the bodies were found in the most extraordinary situations and attitudes, accompanied with plates of the same. In one a man was found in a granary hanging by a cotton handkerchief made fast to a rope which stretched across; the knees were bent, so that the legs formed a right angle backwards; the feet were supported on a heap of grain, over which the knees hung at a distance of a few inches. In another, a prisoner was found hanging to the bars of a window so low that he was nearly sitting on the ground; he had previously tied his hands together. In a third, the body was found in a vertical position, with the heels resting on a window-stool. In the fourth, an Englishman, a prisoner in Paris, hung himself in his cell, which was an apartment with an arched roof, and at the lower part of it was a grated window, the highest part of which was not near the height of a man; nevertheless he hung himself to this grating, and was found almost sitting down, with his legs stretched out before and his hips within a foot and a half of the ground. In a fifth, the attitude of the body was similar to the first: the man had suspended himself to a large iron pin driven into the wall to support the bed-curtains, and his feet, bent at a right angle, rested on the bed, while his knees approached it within a few inches. In a sixth, the point of suspension was so low that the person (a female) was obliged to stretch out her legs, one before resting on the heel, the other behind resting on the toes, in order to accomplish her purpose. In a seventh, a female was found stretched at the foot of her bed, the legs, thighs, and left hip, lying on the floor; the upper part of the body was raised, and suspended by a cord fixed on the neck, and fastened to the hospital-bed. There are other cases recorded in the memoir alluded to, of persons found hung in equally extraordinary situations, but we think it unnecessary to particularize them. A few years ago a man, aged seventy-five, destroyed himself at Castle Carey by fixing a cord round his neck while sitting on his bedside, leaning forward till his purpose was accomplished. His wife, who had for years been bed-ridden, and therefore not likely to have been fast asleep, was in the room during the transaction, and knew nothing of what was going on. (Beck's Med. Jur. by Darwall, p. 283; [or 6th edit. ii. 139: Philad. 1838.)] In order to show the power of the will and firmness of resolution in certain suicides, we quote the following case from Remer, (loc. cit.) « Une femme alla, avec l'intention de se pendre, de la chambre où ses enfans se trouvaient, dans celle où ils couchaient. Sa fille ainée, agée d'environ huit ans, la suivit bientôt, et la trouva pendue; la fille exerça tant de tractions sur sa mère pour a détacher, qu'elle y parvient en rompant le lien. Alors la mère, qui avait toujours la corde au cou, repoussa son enfant dans la première chambre, la reprimanda, et lui ordonna, ainsi du' à ses frères et ses sœurs, de rester où ils étaient, revint sur ses pas, et se pendit une seconde fois. Les enfans allaient chercher du sécours, mais il n'était plus temps." From these cases we learn how quickly consciousness must be destroyed in this form of death; for were it not so, some exertion would be made by the individuals to save themselves after the experiment had been tried to a certain extent.

Strangulation, properly so called, differs from hanging in the individual not being suspended; but whether death be caused by suspension or a ligature drawn tight, or by the hand alone, or any other pressure on the trachea, the physiological phenomena are the same. Strangling is a more common method of committing murder than hanging, arising from the greater facility with which it is accomplished. A remarkable instance of this is that of Dr. Clench, who was strangled in a hackney-coach in London, in 1692, by two men, who called him out in the night under pretence of taking him to visit a patient. After driving about the city for more than an hour the two individuals left the coach, and the coachman found Dr. Clench sitting in the bottom with his head against the cushion. He was quite dead, and had a handkerchief around his neck, in which was a piece of coal placed just over the windpipe. The coachman had not the slightest knowledge of the transaction, having heard no noise while driving the carriage.

The appearances presented by strangled persons, when a ligature has been employed, do not differ much from those already detailed, as characteristic of death by hanging. The position of the rope-mark constitutes the chief point of distinction; if it is not at the upper part of the neck, there can be no doubt the person was not hanged: dislocation of the neck is not to be expected, but the cartilages of the larynx and trachea frequently suffer. The track of the ligature in strangling is horizontal, and usually rather low down on the neck. A question has arisen as to the possibility of strangling being resorted to for the purpose of suicide. Upon this subject Fodéré remarks: « Je dirai relativement au second chef de la question, qu'en général les impressions circulaires laissées par la simple strangulation forment seules une présomption d'homicide, parcequ'il n'est guère possible de se donner la mort par ce moyen, les mains cessant de faire force au moment où la compression commence à s'exercer." (Méd. Lég. tom. iii. p. 174.) Notwithstanding this opinion he relates a case communicated to him by Desgranges of Lyons, on which the Society of Medicine were consulted, and replied that voluntary strangulation was possible. The case was that of an individual found strangled in a hayloft by a handkerchief which had been tightened by a stick. Another case of a similar description is given by the same author. One of a more recent date is recorded by Dr. Dunlop, (Beck's Med. Jur. by Darwall, p. 290,) on the authority of a navy-surgeon, a friend of his. A Malay, who on board of a man-of-war in the East Indies had made repeated attempts to commit suicide, at last succeeded by the means alluded to. He tied a handkerchief round his neck, and with a small stick twisted it several times, and then secured it behind his ear to prevent its untwisting. Jealousy was the cause assigned for the act. The well-known case of General Pichegru, who was found strangled in prison, in Paris, during the consulate of Buonaparte, gave rise to various suspicions; and the rarity of this form of suicide, together with a general disbelief in its possibility, served to strengthen the common fame of that day, that he had been thus privately murdered in order to avoid the risk of a public trial. Certainly the condition in which the body was found seemed to point to such a conclusion. It was lying in bed on the left side, in an easy attitude, with the knees bent, and the arms lying down by the side, with a black silk handkerchief twisted tightly round the neck by means of a stick passed under it. The cheek was torn by the ends of the stick in its rotations. In allusion to this case, Remer (Ann. de Hyg. et de Méd. Lég. t. iv. p. 186,) observes: "Je n'ai d'ailleurs ici aucune intention de me constituer le défenseur d'un homme qui a trop versé de sang pour ne pouvoir pas prendre facilement sur lui un meurtre de plus. Bien mieux, j'accorde que ce genre de mort n'est que très rarement le résultat d'un suicide, mais je doute que sur cette seule considération, et sans autres preuves plus fortes, on puisse absolument affirmer qu'il y a eu meurtre." Indeed, when we consider the number of cases, that occur, of suspension, some of which we have mentioned, where the position in which the body is found establishes with what promptitude the loss of sense must have taken place, or how strong the desire of self-destruction must have been when the resolution was once taken, we think it is going too far to deny the possibility of death by voluntary strangulation, however cautious we may be in receiving testimony on the subject.

Persons destroyed by manual strangulation exhibit, instead of the circular ecchymosis on the neck, irregular patches corresponding to the fingers of the assailant. We must not expect, however, to find the internal mark of suffocation so distinct as in cases of hanging, because the closing of the air-tube not being so complete, the functions of respiration and circulation go on in some measure for a longer time. Traces of violence on the chest and limbs are also frequently observed in consequence of the struggling and force employed in the act.

[In rare cases, strangulation may be accidental. An extremely dissipated, drunken, and disorderly woman went to bed intoxicated, and was found strangled in her bonnet-strings. It appeared that she went to bed with her bonnet on, and falling out of bed, her bonnet became fastened between the bedstead and the wall, and she, being so drunk as to be unable to loosen the strings, was, in consequence, strangled. (Guy, *op. cit.* p. 336.)]

Death by **smothering** is nearly allied to the former. It consists in cutting off the supply of air to the lungs by forcibly closing the mouth and nostrils. This form of death is more usually accidental than intentional, because, unless in the case of very young or old feeble persons, it is a difficult method of committing murder. Children have been smothered in bed accidentally, by the nurse or a pillow, overlaying them in such a manner as to close the mouth and nostrils. Persons in a state of intoxication may be smothered accidentally by falling with the face in mud, shallow water, or the like, and being unable to extricate themselves they perish by suffocation. But drunken persons are also easily destroyed by intentional smothering, of which the woman Campbell murdered by the notorious Burke and Hare in Edinburgh in 1828, furnishes a melancholy example. This was the last of three charges of murder laid in the same indictment as having been committed within six months in the same way, and for the same purpose, of supplying subjects for the anatomists' dissecting-room; and there is now no reason to doubt that, in conjunction with their two accomplices who turned king's evidence, they had carried on the dreadful trade of human butchery to a far greater extent. The direct evidence of the manner of death, as derived from the testimony of the accomplices, was that Burke and Hare were fighting together, when the deceased, in attempting to part them, was struck down by Hare to a sitting posture on the floor; that Burke, as soon as he had overpowered his companion and thrust him on the bed, threw himself on the deceased, kept her down by the weight of his body, and covering her mouth and nose with one hand while he applied the other under her chin, held her thus for ten or fifteen minutes till she was dead. The most remarkable appearances presented by the body when examined two days after death, were the following:—joints flaccid; features composed, red, and rather more turgid than natural; lips affected with dark livor; conjunctivæ of the eyes, even in the horizontal position of the body, much injected with blood; a little fluid blood on the left cheek, proceeding apparently from the nostrils; tongue not protruded or torn by the teeth; the scarf skin under the chin much ruffled, and the surface of the true skin dry and brown when denuded, but without blood or surrounding ecchymosis; integuments every where very free of lividity except on the face; no effusion of blood or laceration of the parts around the windpipe; no injury of the cartilages; the os hyoides and the thyroid cartilage farther apart than usual, in consequence of stretching of their interposed ligament: on the inside of the windpipe some tough mucus, not frothy, with a few points of blood between it and the membrane, which last was healthy; organs within the chest perfectly natural; the lungs remarkably so, and unusually free of infiltration; blood in the heart and great vessels, and indeed throughout the whole body, very fluid and black, and accumulated in the right cavities of the heart and great veins. There were some appearances of violence on the limbs and in the spinal canal, unnecessary to notice, as they were the effects of injuries after death, caused by forcibly doubling up the body to enclose it in a box. Upon this case, Dr. Christison (Edinburgh Med. and Surg. Journal, vol. xxxi. p. 242,) (from whose admirable and detailed account we have extracted the foregoing) very justly observes: "A conviction has gained ground among the public, and has been encouraged by the sentiments currently expressed in society by some medical men, that the signs of suffocation generally, and as they existed in the body of the woman Campbell in particular, are so obvious and characteristic that they would of themselves, and independently of a knowledge of collateral circumstances, at once attract the attention of a professional person conversant with anatomy, and excite a very strong and well-grounded suspicion of the cause of death. This idea, if erroneous, must have a pernicious tendency in various ways. A sufficient reason for my taking notice of it is, that it may throw medical inspectors off their guard, by leading them to expect strongly-marked appearances in every case of death by suffocation. That such appearances are very far from being always present, should be distinctly understood by every medical man.

"In the body of the woman Campbell, no person of skill, whose attention was pointedly excited by being told that from general circumstances murder was probable, but the manner of death unknown, could have failed to remark signs that would raise a suspicion of suffocation. But if his attention had not been roused,—if, for example, he had examined it in the anatomical theatre of an hospital, without knowing that suspicions from general circumstances were entertained regarding it, he might have inspected it even minutely, and yet neglected the appearances in question. Nay, a person of skill and experience would have been more likely to do so than another, because every one who is conversant with pathological anatomy must be familiar with such or similar appearances as arising from various natural diseases."

For persons found dead from *noxious inhalations and poisoning*, see the articles Asphyxia and Toxicology.

Persons found Burned.—In cases where bodies are found dead with traces of extensive burning upon them, the medical jurist, to whom the investigation may be committed, has some delicate and interesting questions to solve. This difficulty has been of late years increased, by the admission of the possibility of spontaneous human combustion, and he is now expected to state—1st, whether burning was the cause of death or not, or, in other words, whether the body was burned before or after death; 2d, whether the burning was spontaneous or ordinary combustion. It is much to be feared that a want of information respecting the peculiarities of these different cases, has led, even in times not very remote, to the condemnation of innocent persons. "On a vu dans le courant du dixhuitième siècle, condamné à périr sur l'échafaud, un malheureux habitant de Rheims, accusé d'avoir assassiné sa femme, et de l'avoir ensuite brûlée, afin de se dérober au supplice qui l'attendait; et M. Vigné a jetté des fleures sur la mémoire de l'infortuné Millet, dont la femme, sujette à l'ivrognerie, fut trouvée le 20 Février 1725, presque entièrement consumée dans sa cuisine, à un pied et demie du foyer." (Fodéré, Méd. Lég. tom. iii. p. 204.) Two cases related by Dr. Christison, (Edin. Med. and Surg. Journ. vol. xxxv. p. 316,) on the authority of the late Dr. Duncan, appear to us of a similar nature. In each the prisoner was accused of having murdered his wife, and burnt the body afterwards to conceal the murder. "The first was the case of a man, Gilchrist, who was condemned and executed at Glasgow. The prisoner and his wife lived on tolerably good terms, but used to take fits of rambling and get drunk for days together. At last, on one of these occasions, after their return home in the evening, the people who lived in the floor above them heard a noise like that of two persons struggling, and soon afterwards a rattling or gurgling and moaning, as of one choking or bleeding to death. They so strongly suspected that all was not right, that they called down to Gilchrist through the floor that they were afraid he was killing his wife. In no long time they were further alarmed by the smell of fire and the filling of the house with smoke; upon which they went down to Gilchrist's apartment and demanded admission. After some delay he admitted them, and in doing so appeared to have come out of an inner room, where he said he was asleep in bed. On letting them in, he stumbled over the body of his wife, who lay in the outer apartment quite dead, kneeling before a chair and very much burnt. In these circumstances the prisoner was accused of having murdered her and then burnt the body to conceal the manner of death; while, on the contrary, he alleged he had gone to bed tired, and knew nothing of what had befallen her till he was awakened by his neighbours, and that he presumed her clothes had caught fire while she was intoxicated and burnt her to death. The medical gentlemen who had been appointed to examine the body, merely reported that they found the body so much burnt that they could learn nothing from it as to the cause of death. The general evidence was all against the prisoner. He was accordingly condemned, although the precise manner of his wife's death was not proved even presumptively, and the sentence was put in execution; but to the very last he vehemently and solemnly denied that he was guilty." The second case occurred to Dr. Duncan within the same year at Leith. "The general evidence was of the same nature as in the case of Gilchrist, but even stronger against the prisoner. He lived on bad terms with his wife. On the evening of her death she returned home at a late hour with a lighted candle, after getting some whiskey at a neighbour's. At this time the prisoner was in bed; but some time afterwards there was heard a considerable noise, like that of struggling, and of chairs pushed up and down the room; and after this the man was heard in an adjoining bed-room, endeavouring to quiet his child, who was crying. Presently the neighbours were alarmed by a strong smell of fire proceeding from the prisoner's apartments. At last a man forced his way in by breaking the window. On entering he found the room full of smoke, and observed something burning red in a corner, over which he instantly threw a pitcher of water, and which proved to be the body of the woman burning on the hearth." Dr. Duncan was present at the examination of the body under the sheriff's warrant, and reports as follows: "We found some parts of the body, especially the belly, burnt to a cinder. We then examined the parts on which the fire had acted more moderately, namely, the face and extremities, and here there was every mark of vital re-action; some spots were merely red and inflamed; others scorched to a hard transparent crust, but surrounded with distinct redness, and a great many blisters filled with lymph perfectly different from those produced on the dead body, which are not filled with a fluid, but with air or vapour. In short, we found appearances exactly similar to those of fire on a living body, and therefore we reported as our unanimous opinion, that the deceased was burnt to death." As there was no proof of the prisoner's having set fire to her, he was not found guilty, but the jury returned the intermediate verdict of *not proven*.

It is worthy of remark, that although the possibility of spontaneous combustion was not mooted at the time of these occurrences, yet the acute mind of Dr. Duncan led him to perceive something extraordinary in the phenomena which presented themselves; and he particularly comments upon the violent and destructive action of the fire, compared with the small quantity of combustible matter consumed. In neither case was there any trace of burning in the house or furniture, and in the last the woman was found on the hearth with part of her clothes unburnt, and a chair from which she had fallen quite entire. She was dead when the neighbours entered, and in the dark the body was discovered by a red light issuing from it.

Upon reviewing these cases, particularly the last, we cannot avoid agreeing with Dr. Christison, that the body was in that singular state in which it is apt to undergo spontaneous combustion; it being difficult to explain otherwise the great extent of injury inflicted. It is not our intention at present to enter into a discussion of the theory of spontaneous human combustion, that subject having been already most fully and ably treated of in a former article, (see COMBUSTION, SPONTANEOUS); but we wish to direct the attention of practitioners to that interesting phenomenon, in order that they may be prepared to detect it when it occurs; and we have mentioned the instances just quoted as examples in which a knowledge of this peculiarly morbid condition of body might possibly have saved the lives of innocent persons.

Was the body burnt before or after death?—This question can only be solved by a reference to the phenomena which are known to occur on the application of a burning heat to a living and a dead body, and by observing those indications of vital reaction which are peculiar to the former, and remain visible after life is extinct. We are indebted to Dr. Christison (Edin. Med. and Surg. Journ. vol. xxxv. p. 321,) for some interesting experiments and observations made for the purpose of arriving at a more certain knowledge of these phenomena; particularly with a view of ascertaining whether the effects of a burn on a living body can be imitated immediately after death by the application of heat. It appears that the most immediate effect of the application of heat to a living body is a blush of redness to a considerable extent round the burnt part, removable by gentle pressure, disappearing in no long time, and not permanent after death. Next to this in order (according to the author quoted), and occurring most generally at the very same time, is a narrow line of deep redness, separated from the burnt part by a stripe of dead whiteness, bounded towards the white stripe by an abrupt line of demarcation, passing at its outer edge by insensible degrees into the diffuse blush already described, but not capable of being removed like it by moderate pressure. In every instance in which Dr. Christison watched the effects of the actual cautery, as well as in those cases observed for him by others, this deep crimson line appeared in a very few seconds, sometimes in five, generally within fifteen, and once only so late as thirty seconds. Dr. Christison never failed to observe this appearance on the bodies of persons burnt a few hours before death, forming a line on the entire skin near the burn, from a quarter to half an inch in breadth, and about half an inch from the burn. Blistering is the next appearance in point of order, but it is not a very constant consequence of a burn if life be extinguished a few minutes afterwards. When the heat is applied by means of a scalding fluid, blisters usually appear in a very few minutes. Yet sometimes, in very extensive burns of this kind, especially in young children, there is no vesication at all in many hours. "It follows, then, that the only effects of burns which appear immediately after the injury and remain in the dead body, are, first, a narrow line of redness near the burn not removable by pressure, and, secondly, blisters filled with serum; that the former is an invariable effect; but that the latter is not always observable when death follows the burn in a few minutes."

In order to try whether these appearances could be imitated by the application of burning substances after death, Dr. Christison made the following experiments:

1. In a stout young man who had poisoned himself with laudanum, a very hot poker and a stream of boiling water were applied to the skin of the chest and inside of the arm one hour after death.

2. A stout young woman died in ten or twelve days of a low typhoid fever, and at her death was but little attenuated. Ten minutes after death boiling water was poured in a continuous stream on the breast and outside of one of the legs.

3. A very powerful, athletic young man poisoned himself with laudanum. Four hours before death a tin vessel filled with boiling water was closely applied on several parts of the anus, and a hot smoothing-iron was held to the outside of the hip-joint. Half an hour after death a red-hot poker was applied to three places on the inside of the arm. The body was examined in thirty-eight hours. "Some of the spots burnt during life presented a uniform blister filled with serum; on two there was no blister, but the cuticle was gone, and the true skin dried into a reddish translucent membrane, at the edge of which there were drops of serum, and also particles of the same fluid dried by evaporation. Round all these spots there was more or less scarlet redness, particularly round the two spots last mentioned. A bright red border, half an inch wide, surrounded the whole burns; and the redness was not in the slightest degree diminished by firm pressure. The spots burnt *after death* were some of them charred on the surface, and not elevated: two presented vesications, but the blisters were filled with air, the cuticle over them dry and cracked, and the surface of the true skin beneath was also quite dry. On the white parts of the skin there was no adjacent redness." Similar appearances were presented in the two former experiments to those now mentioned as the effects produced after death. Three other experiments were made on amputated limbs immediately after operation, with results of a similar nature. From these experiments it appears that the application of heat to the body, even a few minutes only after death, cannot produce any of the signs of vital re-action formerly

described; and that a line of redness near the burn, not removable by pressure, and likewise the formation of blisters filled with serum, are certain signs of a burn inflicted during life.

Was the burning spontaneous or ordinary combustion? We have already referred to the article SPONTANEOUS HUMAN COMBUSTION for an account of this extraordinary phenomenon and its probable causes. It is remarkable that by far the greatest number of victims to this accident are females. Sixteen out of seventeen cases related by Kopp, and all those, amounting to eight, given by Lair, were of this sex. In like manner the four cases mentioned by Dr. Apjohn as having occurred in Ireland, were all old women, and in all the use of spirituous liquors had been carried to a great extent. This kind of combustion penetrates the body with extraordinary rapidity, and the flame which accompanies it is with difficulty extinguished by water: but although it acts so rapidly and extensively on the body, it is observed that objects in the neighbourhood, unless those in actual contact with it, are not attacked. The trunk of the body is the part that suffers most, being generally almost entirely consumed, while the head and extremities are more spared. The rapidity and depth of these combustions, together with the small quantity of other surrounding combustibles consumed, contrast strongly with the slowness observed when bodies are burned on a funeral pile or at the stake, and lead us to understand that similar effects cannot be the work of criminal intention, for when burning is resorted to in order to conceal crime, its operations are infinitely more slow, more imperfect, and extend more to surrounding objects, than in cases of spontaneous combustion.

Persons found Dead from Cold. — Death from this cause is by no means rare in countries where the winter is very severe, as we learn from accounts of travellers in Siberia, Lapland, Switzerland, &c.: and even in these countries, when the winter is unusually severe, cases occur which equally illustrate the destructive effects of cold. If such accidents happen at a distance from inhabited places, in snow and frost, they are generally too strongly marked by circumstances to be mistaken. But they may occur in populous places, and even in large cities, and are then more liable to misconstruction and suspicion. "The degree of cold necessary for the production of its fatal effects varies in a very remarkable degree with the strength and circumstances of the individual to whom it is applied, as well as with the rapidity of the cooling process. In some instances we find man enduring an extreme degree of cold with but little inconvenience, whilst in others we see him perishing in a temperature at which water retains its fluidity." (*Paris and Fonblanque*, Med. Jur. vol. vii. p. 950.) There is a very striking description of the effects of cold in the account of the first voyage of Captain Cook. When the Endeavour was off Terra del Fuego, Sir Joseph, (then Mr.) Banks, Dr. Solander, and some others of the company, wished to make a botanical excursion to a mountain that appeared but a short distance from the shore. They set out, twelve in number, including domestics. An intense cold seized them, which they were encouraged to resist by Dr. Solander, who had crossed the mountains separating Sweden and Norway, and knew the fatal effects of yielding to its influence. He assured them that whoever sat down would sleep, and that whoever slept would never waken. Nevertheless, he was himself the first to yield to the desire for sleep, against which he had warned the rest. He begged to be allowed to lie down; he stretched himself, and slept some time upon the ground covered with snow, and it was with great difficulty that his friend Banks could rouse him to go a quarter of a mile to a fire which he had lighted. A black servant of Mr. Banks lay down also, replying to the threats of death held out to him, that he only desired to be allowed to sleep and die. Dr. Solander, when aroused at the end of five minutes, had almost lost the use of his limbs, and his feet were so shrunken that his shoes fell off. It was not possible to waken the negro, and he perished with another negro who had been left for a moment with him to assist him. All the persons in the expedition felt the effects of the cold more or less, but the whites were all saved, even Mr. Buchan, a painter, who had a fit of epilepsy, to which he was subject.

In this example, as well as from more recent observation in the polar seas, it appears that a great degree of cold, particularly when joined with fatigue, produces in the body a stupor and numbness almost insupportable, and that the ardent desire to sleep arising from this stupor is such that it cannot be conquered by the fear of the consequences. We also perceive that men least accustomed to cold are those who most readily sink under its influence, as we find the negroes dying while the whites were saved; and also that strength of mind and body tended much to enable the sufferer to resist, since Sir Joseph Banks, a man endowed with great moral and physical energy, was the one who suffered least of the whole party. The same cause will enable animals to sustain cold with impunity. For instance, among hybernating animals, as the dormouse and marmot, it has been observed, in experiments made to ascertain the cause of their sleep, that the most vigorous are the most susceptible of invigoration by heat; and that they are least readily thrown into a state of slumber by artificial cold during summer. Fodéré, who was a Swiss, says that while inhabiting his native mountains, all the cases of death of this nature whose histories he could discover, were of sickly persons, children, old men, or females. From the experiments of Mr. [Sir B.] Brodie, to ascertain the source of animal heat, it is plain that the temperature of animals is in some way or other dependent upon the integrity of the functions of the nervous system; and hence the power of an animal to resist cold will be determined by his power of generating heat. Now it is found that any cause by which the powers of the nervous system are impaired favours the action of cold upon the body; and for this reason an individual labouring under the effects of a narcotic may be killed by a degree of cold that otherwise would have been quite supportable. It is for this reason, also, that intoxicated persons perish in severe cold more readily than those whose nervous system is not so impaired. Dr. Paris (loc. cit.) notices two instances that occurred in London, a few winters back, of drunken persons being taken to the watch-house, and there not being any charge against them they were dismissed by the constable of the night, and perished in the streets. A military friend of his communicated to him an instance where, out of a great number of troops who were exposed to intense cold, the only one who perished was under the influence of intoxication. This was also exemplified on a large scale in the disastrous retreat of the French troops from Russia; for we learn from La Beaume's account that intoxication seemed to insure death.

Mr. [Sir B.] Brodie is inclined to think that cold probably destroys the principle of vitality equally in every part, and does not exclusively disturb the functions of any particular organ. This opinion is supported by the experiments of Dr. Chassat.

In cases of persons found dead from cold, if the accident be recent, attempts may be made to restore life. The application of heat should be very gradual; and artificial respiration may be tried with a prospect of utility. Internal stimulants should be cautiously administered after signs of returning animation are apparent.

Persons found dead from Hunger.—Food being necessary to the maintenance of life, it is plain that its deprivation cannot be endured for any length of time without causing death, and those cases of long fasting, or of refraining altogether from food for years, have all turned out to be impositions. It has, however, been ascertained that the want of nourishment is borne differently by different persons, a difference depending on age, health, constitution, sex, &c. Thus, a great number of persons doomed by some calamity at sea or elsewhere to perish by this dreadful death, do not all die at the same time, but some, according to their constitution, have the sad privilege of surviving their companions in misfortune. Young persons bear hunger worse than old, and sooner sink under its influence,—a fact no less correctly than beautifully illustrated by Danté in his description of the sufferings of Count Ugolino and his children, four in number, all enclosed in a dungeon together, and condemned to death by starvation. The father is represented as surviving until the eighth day, having witnessed the death of his sons in the order of their age, beginning with the youngest. We see that in general, of the two sexes, women bear the privation of food more easily than men; thus, in all accounts of long voluntary abstinence, three-fourths or more of the individuals are of the female sex. Women usually do not consume much, and all being equal as to age and health, they require much less nourishment than men. The power of resisting hunger varies also with the total privation or otherwise of water. Redi (Osservazioni intorno agli Anim. viventi, No. 3, 4,) made many experiments to discover how long animals could live without food. Of many fowls that he kept without eating or drinking, none passed the ninth day. He gave to one as much water as it chose, of which it drank freely and often during sixteen days, and it did not die until the twentieth. Dogs in like manner lived much longer when allowed water. But it would appear from a number of instances, that the moisture of the atmosphere of the place in which an individual may be confined may compensate in some degree for the want of drink. Foderé relates an instance where three women in Piedmont were overwhelmed by snow, and shut up in a narrow stable without any provision for thirty-eight days, and at the end of that time were rescued alive; and he thinks it probable that they owed their preservation to the moisture of the place of their confinement; the absorbents of the skin being thus able to derive a certain portion of the fluid for the use of the system. Chaussier reports the case of some workmen who remained fourteen days without eating or drinking, shut up in a deep damp quarry, by the sudden falling in of the roof. They were withdrawn at the end of that time, with a small feeble pulse, scarcely any heat, and just a spark of life remaining, which was with difficulty kindled. The absorption of moisture had sustained them, as it did the women at Bergamoletto. A very striking instance of the power of water to prolong life occurred in the case of Luc Antoine Viterbi, who starved himself to death in prison at Corsica. (*Paris and Fonblanque*, Med. Jur. v. ii. p. 69.) From the fifth to the sixth day, to hunger insensibly succeeded the much more grievous suffering of thirst, which became so acute, that on the sixth, without ever deviating from his resolution, he began to moisten his mouth occasionally, and to gargle with a few drops of water to relieve the burning pain in his throat; but he let nothing pass the organs of deglutition, being desirous not to assuage the most insupportable cravings, but to mitigate a pain which might have shaken his resolution. Until the tenth the thirst became more and more intolerable, when, overcome by excess of pain, he seized the jug of water and drank immoderately. On the thirteenth, the unhappy man thinking himself at the point of death, again seized the jug and drank twice. On awakening on the morning of the fourteenth, and finding his powers restored, he fell into a rage with his keepers, protesting that they had deceived him, and then began beating his head against the wall of his prison, and would inevitably have killed himself had he not been prevented. During the nineteenth, the pangs of hunger and thirst appeared more grievous than ever; so insufferable indeed were they, that for the first time Viterbi let a few tears escape him, but his invincible mind instantly spurned this human tribute. On the twentieth, he declared to the gaoler and physician that he would not again moisten his mouth, and feeling the approach of death he stretched himself, asking, as on a former occasion, whether he was well out, and added, 'I am prepared to leave this world.' Death did not this time betray his hopes. On the twenty-first Viterbi was no more. In this interesting case, which we have here abridged, we perceive the effect of a small portion of fluid in producing vigour in a body worn out by abstinence. There can be no doubt Viterbi would have died much earlier if he had not made use of the water. In the examination of bodies dead from hunger, the following characters are usually observed. There is general emaciation of the body, together with an acrid fetid odour. The eyes are open and red, the tongue and throat dry, and the intestinal canal is empty. The gall-bladder is usually filled with bile, which exudes and tinges the neighbouring viscera. The lungs are shrivelled, and all the other organs healthy. It is thought by Fodéré that some conjecture may be drawn as to whether the person has been totally deprived of water or not; for, according to the experiments of Dumas, the dogs which he killed by thirst had the viscera inflamed, and the blood thick and coagulated — phenomena which did not present themselves in the bodies of those dead from hunger alone.

Persons found dead from Lightning. — Death from this cause is sufficiently common to warrant a consideration of it in this place. Its phenomena may be studied by observing those of common electricity, as it has been sufficiently proved that they are identical. The human body is alike affected by both, and death, whether it be occasioned by the discharge of an electrical battery or by that of a thunder-cloud, exhibits effects precisely analogous. Two theories respecting the manner of death by lightning are extant, the first that of Mr. Hunter, the second of Mr. [Sir B.] Brodie. Mr. Hunter supposed that when death is thus occasioned, there is an instantaneous and total destruction of the vital principle in every part of the body, and that the muscles are therefore relaxed and incapable of contraction; that the limbs do not stiffen as after other forms of death, nor does the blood coagulate, and that putrefaction is rapidly set up. On the other hand, Mr. [Sir B.] Brodie concludes from his experiments, given from his manuscript notes by Dr. Paris, (Med. Jur. vol. ii. p. 64,) that an instantaneous extinction of vitality does not take place, but on the contrary the functions of the brain are those on which the electric shock exercises its primary influence. In one of his experiments an electric battery of six jars having been charged with electricity, the shock was made to pass through a guinea-pig in the longitudinal direction from the head to the tail. The animal immediately fell on one side insensible, as if stunned; a convulsive action of the muscles of the extremities was observed, but did not long continue, and the function of respiration was not interrupted. In a few minutes sensibility was restored and the animal recovered. In another experiment a shock from nine jars was passed in the same manner through another guinea-pig. The animal immediately fell on one side, exhibited a convulsive action of the voluntary muscles of the limbs, but uttered no cries, and although attentively watched, no signs of respiration could be discovered after the shock had passed through. Three minutes afterwards Mr. [Sir B.] Brodie opened the chest, and found the heart acting with regularity and vigour about eighty times in the minute, and circulating dark-coloured blood. The peristaltic motions of the intestines were also visible, and the muscles obeyed the galvanic stimulus.

In this experiment it is plain that neither the irritability of the muscular system at large nor that of the heart was destroyed by the shock, but death took place as from a severe injury of the head and destruction of the functions of the brain. In this case Mr. [Sir B.] Brodie remarks, that if the lungs had been artificially inflated, the action of the heart might have been maintained, and the animal probably restored to life.

When a discharge of lightning strikes a human body, it may affect the surface and produce vesications, which most commonly, according to Mayer, pass in the direction of the spine; or it may penetrate a particular part of the body and act locally. The clothes are not unfrequently torn, and buttons, coin, or other metallic substance melted, but occasionally cases are met with where the clothes are uninjured. Death has sometimes occurred when the thunder-cloud has appeared to be at a considerable distance. This is accounted for by supposing it to be a discharge of electricity from the earth to the cloud, which had become negatively electric, constituting what is termed the returning stroke. All discharges of electricity occur in consequence of the approach of two bodies in opposite states of electrical excitement. When a substance excited positively is brought near another in its natural state and insulated, the electric equilibrium of the latter is instantly disturbed, the parts nearest to the former become negative, and the distant ones positive. If the body is not insulated, its electricity passes into the earth, and the whole becomes negatively electric. If, on the contrary, the exciting body be negative, it causes the contiguous parts of a body in its vicinity to become positive. Hence it is established as a law, that an electrified body tends to produce in a contiguous substance an electric state opposite to its own. The electricity developed in this way is said to be induced, or excited by induction. The construction of the Leyden phial is upon this principle; when the inside of the jar is rendered positive by contact with the prime conductor, the outside, if in communication with the earth, parts with electricity and becomes negative; both surfaces are therefore electrified, but in opposite states; and if a communication be established between them by a good conductor, the excess of electricity instantly passes along it, and both sides of the jar return to their natural condition. Now when a negatively electric cloud approaches the earth, all objects in its vicinity are positively excited, and when it comes within striking distance, — that is, so near that the tendency of the electricity to pass from the positive to the negative body overcomes the resistance of the intervening portion of air, — the equilibrium is restored with a report and a flash of light, exactly as in the discharge of the Leyden phial. If a person is found in an open place or under a tree shortly after a thunder-storm, with the ordinary appearances mentioned above, we may attribute his death to lightning, and particularly so if the metallic substances about him are found melted and his clothes torn or burnt, while dissection exhibits no other cause of death.

Persons found dead from Wounds. — On the trial of Count Koningsmark for the murder of Mr. Thynne, Mr. Hobbs, the surgeon, being pressed by counsel to discriminate between the relative mortality of certain wounds found on the body of the deceased, replied, "I believe there never was a wound but it might prove mortal." This is an opinion in which every one who has had opportunities of witnessing a variety of injuries must coincide, from the extraordinary and unexpected results which sometimes follow. Thus, individuals have been known to recover from wounds which, from their extent and the importance of the organs implicated, left no room for hope; while others have perished after the infliction of violence so slight, and producing such trivial local effects, as to have almost escaped observation. Such consequences, however, must be considered as exceptions to the usual course observed in similar instances; and taking wounds in general, we must admit that they allow of classification in reference to their mortality. Any such classification can never be made complete or definite, from the exceptions just alluded to, as well as from the impossibility of proving the absolute similarity of two wounds, however they resemble each other, when one individual dies and the other recovers, and also from the endless varieties of constitution in different individuals. It is, therefore, upon their usual or more common effects that such a division can be adopted for our present purpose.

The term wound, in medico-legal phraseology, is much more comprehensive than the same word in surgery. In the latter it means a solution of continuity; but in the former it also comprises injuries of every kind caused by mechanical violence, such as bruises, contusions, fractures, luxations, &c. in which sense it is to be understood in the observations that follow.

[It would appear, that the present rule in England is, that no injury constitutes a wound in law unless the continuity of the skin be broken; so that in a case where blows were inflicted with a hammer or iron instrument sufficient to break the collar-bone, and violently bruise but not break the skin, it was held not to be a wounding within the statute (Archbold.) A man was tried at the Central Criminal Court, in August, 1838, on a charge of cutting and wounding the prosecutor. The prisoner struck the prosecutor a severe blow on the temple with a heavy stone bottle, which was thereby broken to pieces. The prosecutor fell senseless, and it was a long time before he recovered. The medical witnesses underwent a rigid cross-examination by the prisoner's counsel, respecting the meaning of the word "wound." They said that there had been a separation of the cuticle or outer skin of the temples, although there was no absolute wound in the usual acceptation of the word. They farther deposed that the prosecutor had lost the sight of his left eye, and the hearing of his left ear, and he was for a considerable time in a state of great danger, from which he had scarcely recovered. The prisoner's counsel maintained that the injuries were not such as to constitute cutting and wounding in law. The court said, in order that a wound, in contemplation of law, should have been inflicted, it was necessary that the *whole skin*, and not the mere cuticle, should have been separated and divided; and as the evidence did not show distinctly, that there was such a wound, those counts of the indictment could not be sustained. The prisoner was found guilty of an assault. (Taylor, *A Manual of Medical Jurisprudence*, p. 282: Lond. 1844.)]

The chief points to be decided by the medical examiner in the case of a body found dead with wounds, are,—1st, Were they inflicted during life? 2dly, were they the cause of death? and if so, were they the result of suicide or homicide? In order to settle these points, it will be necessary to consider the classification of wounds just alluded to. They have been divided, for the purpose of medico-legal inquiry, into four classes,—1st, those absolutely mortal; 2d, dangerous; 3d, not mortal; 4th, accidentally mortal. This division of wounds is founded, as has been already stated, upon the usual terminations of such injuries, because it is well known that death sometimes follows those of the slightest description; and that others of the gravest kind terminate in recovery. Metzger (Page 327, and *Beck*, by Darwall, p. 324) mentions an instance of death from hemorrhage brought on by the slightest scratch of the thumb-nail. Dr. Paris (Paris and Fonblanque, Med. Jour. v. ii. p. 116) states he has seen a case in which the extraction of a tooth was followed by death in forty-eight hours; and a similar case is reported by Mr. Blagden, (Med. Chir. Trans. vi. viii. p. 224.) An instance occurred lately to the writer of this article, in which a fatal hemorrhage followed a superficial incision made into the upper gum of an infant to liberate one of the incisor teeth. On inquiry, it appeared that another child of the same family had died of hemorrhage from some equally slight cause. Leech-bites have been known to produce death in children; and in the case of Brain (Cro. Eliz. 778. Paris and Fonblanque, v. ii. p. 122) tried for the murder of Watts, it was proved that the deceased died instantly from a blow on the calf of his leg. On the other hand, we are not without instances of equally surprising recoveries from injuries of the severest kind. We have seen persons survive extensive fractures of the skull, in whom portions of the brain have protruded. Dr. Male mentions the case of a mendicant in Paris, from whose skull a portion of the bone was detached, large enough to be used by him to receive alms. The celebrated case of Mr. Tipple, (related by Mr. W. Maiden. London, 1812,) whose thorax was transfixed by the shaft of a gig, is a striking illustration of the present subject. Dr. Dunlop (Beck's Med. Jur. p. 332) records a case of duel in the West Indies, in which one gentleman hit another in the eye, the ball of which was completely obliterated; and the leaden bullet, passing in through the orbit, came out in front of the external ear; nothwithstanding which destruction of the eye as well as injury of the brain, the officer recovered with the same facility as if he had only undergone the infliction of a flesh-wound.

On account of these variations from the usual course, the consideration of injuries from wounds in a medico-legal point of view, is, on the continent, and was formerly in these countries, a matter of much more intricacy than it is at present. A person inflicting a wound on another was held amenable for the consequences during a year and a day; a most inconvenient principle of responsibility, and one particularly calculated to create confusion, by either involving the innocent or suffering the guilty to escape. Chaussier relates a case illustrative of this point. Two men who had had some previous misunderstanding, encountered each other on a public walk, when, after some altercation, one of them struck the other with a light cane and retreated; the other, enraged, pursued him, but had not advanced many steps when he fell dead. On examination of the body, it was found that he had an aneurism of the aorta, which had burst from the excitement under which he laboured at the moment. Fortunately for the administration of justice in this kingdom, that act of the legislature called the "Ellenborough Act," relieves the medical witness of the present day from those serious embarrassments under which our predecessors must have laboured; as by it, wounding with an attempt to kill is deemed equally criminal whether death be the result or not. This, considering man as an accountable being, is the true and just view to take of the crime. Still, however, the testimony of the medical witness will always be important, as by the nature of the injury, its seat, and direction, the evil intent is often to be inferred.

Of *mortal* wounds those which cause instant death are wounds of the brain, of the heart, and large vessels connected with it, of the spinal marrow on the neck, and blows on the stomach; these are all for the most part followed by immediate death. Wounds of the brain must be considered as less fatal than those of the heart, in consequence of the recoveries which are sometimes observed to take place after them, and even wounds of the heart are not necessarily immediately fatal. The late Duc de Berri lived for eight hours after being stabbed through the left ventricle, and similar cases are on record. Next in order as mortal wounds may be mentioned those which interfere with the function of respiration, such as extensive wounds of the diaphragm, and injuries which lay open both sides of the thorax in a considerable degree, and thus impede the dilatation of the lungs. Among *dangerous* wounds must be ranked those of the pharynx and œsophagus, stomach and chylopoietic viscera, the danger of which will be of course in proportion to the extent of the injury. Also, wounds of the urinary bladder and of large blood-vessels in the head, thorax, and abdomen; severe contusions over any of these cavities; wounds of the extremities implicating the great blood-vessels, or causing compound fractures, or in tendinous situations from the danger of tetanus supervening. In the class of *slight* wounds are included those injuries by which the skin and muscles are bruised or divided, and where no tendon, aponeurosis, large nerve, or blood-vessel is touched, and the system has not received any severe shock; to this class belong simple fractures and luxations. The last class, or *wounds accidentally mortal*, are influenced by different causes, which render this division an arbitrary one, and will be considered when we come to treat of those circumstances which alter the medico-legal character of wounds.

In the article Pseudo-morbid Appearances, [and in a previous part of this article,] allusion has been made to the spontaneous lividities which occur on the surface of dead bodies; the nature and causes of which, and the means of distinguishing them from the effects of contusions inflicted before death, are there pointed out. But there is another source of error connected with the examination of the surface, which it is necessary to dwell a little upon before we proceed to consider wounds of particular parts; that is, the possibility of appearances being caused by violence offered to the body after death, which will resemble those that result from injuries received during life.

That such a resemblance does occur is certain, if the blow be inflicted within a certain time after dissolution, and the power of discriminating between the two is of the utmost moment to the medical jurist. We are indebted to Dr. Christison for the most accurate information we possess upon this subject, (Edin. Med. Surg. Journ. v. xxxi. p. 236.) His attention was forcibly drawn to it on the occasion of the trial of Burke and Hare at Edinburgh for the murder of the woman Campbell for the purpose of selling her body. Before the confession of the accomplice, the whole weight of the case rested on the medical evidence; and one of the questions to be answered was, whether certain bruised marks and subcutaneous extravasations of blood, found on different parts of the body, were indications of injuries received before death. Being unable to find in authors on medical jurisprudence any information precisely applicable to the case, except what rested on physiological speculation, Dr. Christison proceeded to subject the question to the extent of experiment. For this purpose, a large dog being strangled, and the hair on various parts of the head, trunk, and legs, being shaved, heavy blows were inflicted on these spots with a hammer, at intervals of from five minutes to two hours after death; but at the end of twenty-four hours no trace of injury appeared in the seat of any of the blows. The next experiment was made on the body of a female an hour and three-quarters after death. Several heavy blows were inflicted with a stick across both shins, on the fore-part of the thighs, on the breast, and on the side of the neck. In less than ten minutes, deep bluish-black discolorations followed the blows on the breast and neck. Twenty-five hours after death the blows were shown on the thighs, by faint stripes consisting of bluish-black points. On the breast and neck the stripes were as deep in tint as any contusions inflicted during life, but without swelling, the colour corresponding with the prominent part of the stick. A severe blow had been struck over the crest of the ileum twenty-three hours after death, which caused ruffling of the cuticle at the time, but no further appearance of injury. The third experiment was on the body of a man. It was struck with a stick on the left side of the back three hours and a quarter after death. More blows were struck on the right side seventeen hours after death. An examination was made forty-seven hours after death, when the blows first struck were marked by two long narrow stripes of dark lividity, with an intervening colourless stripe corresponding with the prominent part of the stick. The redness was confined in this, as in the former case, to the mere surface of the true skin, the rest being natural. The marks of the latter blows consisted of dryness and brownness of the surface, without effusion. The fourth was on the body of a young man, four hours after dissolution. It was struck with a stick, and on subsequent examination it was found that wherever the cuticle had been comminuted, the mark was dry and brown, but there was no other discoloration of the skin. The subject of the fifth experiment was a stout young man, on whose back several heavy blows were struck with a mallet two hours after death. The body was inspected five hours afterwards, and presented deep lividities in the seat of the blows, but the substance of the skin was nowhere infiltrated or discoloured. The general conclusions to be drawn from the preceding facts are thus stated by Dr. Christison.

"In respect to *external contusions*, the experiments show that for some hours after death blows will cause appearances, which, in point of colour, do not differ from the effects of blows inflicted recently before death; that the discoloration generally arises, like lividity, from an effusion of the thinnest possible layer of the fluid part of the blood on the outer surface of the true skin; but sometimes also from an effusion of thin blood into a perceptible stratum of the true skin itself; and that dark fluid blood may be even effused in the subcutaneous cellular tissue in the seat of the discolorations, so as to blacken or redden the membranous partitions of the adipose cells, but that this last effusion is never extensive. It can hardly be doubted that the appearances now described will exactly imitate slight contusions inflicted during life; but I conceive that the blows in the latter case must be trivial."

"When a blow inflicted during life is more severe, it may have the following effects, few or none of which, so far as we know, can originate in violence after death. 1. There may be swelling from the amount of the extravasation; this is certainly never caused in the dead body. 2. When the violence has been applied a few days before death, there will be a yellow margin round the black mark, which is another appearance that cannot be formed except during life. 3. There may be clots of blood in the subjacent cellular tissue, either with or without swelling: these appearances I have never seen accompanying contusions caused in the dead body; but it may be doubted whether clots might not be formed if the injury was inflicted very soon after death, and had the effect of lacerating a considerable vessel in the neighbourhood of loose cellular tissue. 4. In the instances in which the blood does not coagulate at all after death, contusions caused during life may be recognised by the extent of the effusion into the cellular tissue. In a part not liable to be infiltrated by its depending position, and not in the vicinity of a large vein, a deep effusion of fluid blood, which fills and distends the cells of the cellular tissue can hardly be produced on the dead body. 5. Perhaps one of the most characteristic signs of a contusion inflicted during life is, incorporation of blood with the whole thickness of the true skin, rendering it black instead of white, and increasing its firmness and resistance. This sign may not be always present, for, as every one knows, a blow may cause extensive extravasation below the skin, without affecting the skin itself. But when present, I am disposed to consider it characteristic, because I have never been able to produce it in the dead body, and it is not easy to conceive how such a change can be wrought in so dense a texture as the skin, without the force and agency of living vessels."

"It is impossible to fix absolutely the limit of the interval beyond which contusions cannot be imitated by violence applied to the dead body. It appears to vary with the state of the blood, and the time which elapses before the body cools, and the joints stiffen. Sometimes the appearance of contusions can hardly be produced two hours after death (*Experiment 5th*); sometimes they may be slightly caused three hours and a quarter after it (*Exp. 3rd*); but I should be inclined to think this period very near the extreme limit. Wherever the warmth of the body and laxity of the muscles were not considerable at the time the injury was inflicted, we may be sure the appearance of contusions cannot be considerable (*Exp. 2d*). It is probably, therefore, only on the trunk that even in the most favourable state of the body, namely, when the blood remains altogether fluid, any material mark of contusion can be produced so late as two hours after death."

With respect to wounds of the head, it is well known that all kinds of violence are more dangerous in some constitutions than in others. In good constitutions, wounds may not be dangerous, which in old, bilious, or scrofulous habits, are often attended by death, chiefly in consequence of the erysipelatous inflammation that succeeds them. Fracture of the bones of the cranium may take place without any correspondent injury of the integuments, and the symptoms in such cases are extremely equivocal and deceitful. A mere simple fracture when no more is implied than solution of continuity confined to the bony substance without displacement or injury to the neighbouring parts, is not necessarily an event of great importance. In so simple an occurrence we can hardly suppose bad consequences to arise. Simple cases like these, however, are very rare, and these injuries are almost always complicated with some affection more or less severe of the internal parts. Although fractures may be considered more dangerous when accompanied with depression, yet we cannot ascertain the precise degree of injury sustained by the contents of the cranium from the external wound, nor does it follow that the more extensive it is, the more certain is the danger. In fact, our knowledge of the economy of the brain is very limited, and though injuries of it are generally of a most serious character, yet we find surprising recoveries take place. The effusion of a small quantity of blood or pus upon its surface may, and often does, cause the most alarming symptoms, and terminate in death; while, on the other hand, large portions of the brain itself have been removed, and foreign bodies, as a musket-ball, and portions of the skull have been lodged in it, and recovery has taken place. It is hence exceedingly difficult to define the exact amount of injury to the head necessary to cause death; nevertheless, in case of a body found dead with fracture of the skull, and where no other sufficient cause of death can be ascertained, we are justified in attributing the event to the injury. We come to this conclusion from our knowledge of another effect of violence offered to the head, and which must always accompany the former in a greater or less degree,—namely, concussion or commotion of the brain. By concussion of the brain is meant a violent and sudden shake of the organ without any apparent wound or mark of injury being left. It may be caused by violence offered directly to the head, or transmitted to it by falls on the feet or nates. A remarkable instance of the former is given in the Transactions of the Royal Academy of Paris. A stout young criminal was condemned to be broken on the wheel, and wishing to escape the execution, ran head foremost against the wall of his dungeon, and instantly fell dead. On opening the head, not the slightest appearance of injury was discoverable in either skull, brain, or spinal marrow, except a very minute separation in the squamous suture of one side.

Certain injuries done to the face belong to this division of wounds. When these are confined to the face alone, the most serious consequence may be no more than deformity; but mortal wounds have been inflicted through the face on the contents of the cranium. The most common of these is where a sharp-pointed instrument is struck into the eye, and pierces the orbital plate of the frontal bone. The celebrated comedian Charles Macklin was tried in the year 1753 for the murder of a brother-player, whom he struck accidentally in the eye with a cane, in some altercation that took place in the green-room. (State Trials.) Thomas Hallum, the sufferer, died the next day, and it was found that the point of the cane had passed through the orbital plate, and wounded the brain. A case occurred some years ago in Dublin of a similar nature. A gentleman received a thrust of a watchman's pike in the eye, in some drunken broil in the street: the immediate effects were so trifling, and the external wound so slight, that he took no notice of it until he was attacked with inflammation of the brain, which killed him in a few days. Mr. Colles, under whose care he was, opened the head, and found a small round hole in the orbital plate of the frontal bone, in the neighbourhood of which there was a large collection of pus. The part is preserved in the museum of the College of Surgeons of Dublin. In like manner, blows upon the nose have not only crushed that organ, but also driven the ethmoid bone up into the brain; and sharp-pointed instruments have sometimes penetrated the brain through this organ, and proved fatal. Such instances as these show how necessary it is to investigate with the greatest accuracy all cases of sudden death; for without the greatest care and attention, cases of this description must elude discovery. We make this observation in order to induce medical examiners to bestow more pains on the highly important trust they undertake, for it must be confessed that in investigations of this sort, we fall far short of the diligence of our Continental brethren.

As connected with wounds of the head, we may observe that children, either before or after birth, may be, and have been, destroyed by fine sharp-pointed instruments passed through one of the fontanelles. A Parisian midwife was executed some years ago on its being discovered that she was in the habit of procuring still-born children for those who desired it, by piercing the brain of the infant before its birth with a fine wire. A wound of this description leaves very little mark, and would of course escape superficial observation.

The neck comprises many important parts, a wound of which is necessarily followed by death. Wounds of the integuments and muscles of the neck may be considered simple wounds, although they are sometimes difficult to heal in consequence of the mobility of the parts; but wounds of the carotid arteries, jugular veins, and spinal marrow, are for the most part immediately fatal. Lacerated wounds of the carotid artery, however, may not be quickly followed by death, an instance of which came within our knowledge some years ago. The artery was torn by the horn of a cow, and the bleeding from the wound, although considerable, was not sufficient to destroy the patient, who survived long enough to have the artery tied, and subsequently recovered. It has been said that a complete division of the trachea is mortal; but the danger attending a wound of this sort arises from the injury usually inflicted upon the great vessels and nerves in its neighbourhood at the same time, more than from the wound of the air-tube itself, for we know that mere division of this part is not necessarily fatal, although it may be very difficult to heal from the great mobility of the part, and the constant passage of the air through it. Wounds of the pharynx and œsophagus are much to be dreaded, as well on account of the other important parts which must be wounded along with them, as from the circumstance that through this channel the nourishment of the body is conveyed, and that the act of deglutition is directly opposed to a speedy adhesion of the parts. The following case gives a good picture of the dangers and difficulties attending wounds of these parts. (Edin. Med. Surg. Jour. v. xvi. p. 353.) A few years ago a prisoner in Edinburgh jail cut his throat transversely, dividing the larynx quite across at the upper end of the cricoid cartilage, and the separated extremities receded from each other to the distance of three inches; the great vessels and nerves escaped injury from the cut being so high. The professional gentlemen who saw him were satisfied that the œsophagus was also cut entirely across. Several attempts must have been made, as another opening was afterwards discovered in the windpipe. In this state a junction of the parts was found to be impracticable, and the ligatures that had been applied with the view of making the best possible approach were separated by his incessant exertions in passing water through the mouth, and out at the wound, in which way he used several buckets full in the course of one day. He was supported in the first instance by nutritious enemata, and afterwards by means of a tube conveyed through the wound into the œsophagus and stomach. After much trouble to the practitioners, and considerable risk to the patient, the functions of breathing and ingestion were carried on through a tube in each passage introduced by the wound, the tracheal tube being removed when it was necessary to apply the other. The man was afterwards tried, acquitted, and liberated from jail, and continued to live under the disadvantages mentioned. Besides the parts just alluded to, the neck gives passage to the par vagum and the great sympathetic nerve, injuries of which, even partial or at but one side, must be considered of the most dangerous kinds, as from them principally the cardiac and pulmonary plexuses are formed. Injuries to the spinal marrow, either by fracture or dislocation of the vertebræ, or by a wound penetrating between two of the vertebræ, are absolutely fatal. Fracture or dislocation is generally the result of accident, as a fall, or what coachmen are liable to—striking the head against a low arch-way in driving under it. They also sometimes, though rarely, occur in hanging. But they may happen in consequence of disease; a striking example of which came under the observation of the writer some years ago. A boy, who was under treatment in the Richmond Hospital (Dublin) for some disease of the leg, was one morning, during the visit, sitting up in his bed talking to those around him, when his head suddenly fell forward on the breast, and he dropped dead. On examination, it was found that the root of the odontoid process of the second vertebra, and the transverse ligament that binds it in its situation, was ulcerated, and in the motion of the head it had broken off, and compressing the spinal cord, had produced instantaneous death.

A consideration of the important organs contained in the thorax will lead us to estimate the danger arising from wounds which penetrate sufficiently deep to reach them. Wounds of the lungs we know are not necessarily fatal, though for the most part they are exceedingly dangerous, from the size and number of the blood-vessels by which they are traversed. These organs are sometimes seriously injured although no external wound be present. This arises from the fractured portion of a broken rib being driven into their substance, of which injury hemorrhage, emphysema, and inflammation, are the consequences most to be dreaded. Nevertheless, although injuries of these organs are of a very serious nature, and not unfrequently terminate fatally, we find occasionally that they support most extensive injury. This is familiar to many military and naval surgeons who during the late war had opportunity of observing the powers of nature in repairing extensive injuries of these organs; and we before alluded to the case of a gentleman who recovered after having both sides of his thorax transfixed by the shaft of a gig. It is quite true that penetrating wounds of the heart are, generally speaking, mortal; but there are so many cases on record of individuals who survived, some of them for days, others entirely, after wounds of this organ, that we cannot agree with those authors who maintain that such injuries are necessarily and instantly mortal. At the battle of Corunna a soldier received a shot in the chest and fell insensible. He was found by a comrade with signs of life, who carried him off the field, and he was immediately embarked with the troops and brought to Plymouth, where he died fourteen days after the receipt of the wound. Mr. Fuge, who records the case, (Edin. Med. Surg. Jour. v. xiv. p. 129,) states that, on examining the body, two quarts of blood were found in the left side of the thorax, the lung of that side being compressed towards the spine. A transverse opening an inch long was observed in the right ventricle of the heart near the origin of the pulmonary artery, and the ball was lying in the pericardium. To the same paper is appended an account of a suicide who lived forty-four hours after discharging a pistol into his breast, and in whom the right ventricle was found wounded, and the ball in the pericardium. Dupuytren, in his "Leçons Orales," expresses his opinion that wounds of the heart are oftener cured than is generally imagined. He founds his belief on the instances of animals killed in the chase, in whom balls and the cicatrices of former wounds have been found, and also on similar instances in the human subject. Many individuals have presented all the symptoms of wound of the heart, and yet recovered; and he alludes particularly to the case of a soldier, in whom, six years after the healing of a wound of the chest, a musket-ball was found in the right ventricle of the heart, near its apex. From these circumstances we think we are justified in stating that wounds of all parts of the heart, provided they are narrow, are not necessarily immediately fatal. Acupuncture of this organ has been practised at Warsaw with impunity. If, however, the wound be considerable, some lines for example, death is usually instantaneous, from the great deluge of blood that is poured into the pericardium and chest. Under a wound of less dimensions the individual may survive for some days. Thus, in one of the cases mentioned by Dupuytren, a man thirty-four years of age received two stabs of a knife, one in the belly, the other in the chest, of six and seven lines in length. He lived for eight days, and then died with symptoms of diseased brain, having been affected with tetanic convulsions for two days before his death. The stomach was found perforated, and there were four ounces of blood in the left side of the chest, which had come from one of the intercostal arteries opened by the wounding instrument. In the pericardium was observed a perforation three lines and a half long, and a wound of the same extent in the middle of the left ventricle. In another individual, who died mad, after attempting suicide by amputating the penis, several small wounds of the heart were found, which must have been inflicted several days before with a small round instrument found in his possession. Another man, aged forty years, lived seventy-two hours with three wounds penetrating the left ventricle, inflicted by himself with a sharpened file. In the thesis of M. Sanson numerous instances are mentioned of persons surviving wounds of both ventricles, some of them for twenty days. The late Duc de Berri, whose instance has already been alluded to, lived for eight hours, although stabbed through and through the left ventricle with a long round instrument used by saddlers in piercing leather. All these instances go to prove that wounds of this organ are not necessarily instantaneously fatal,—a very important fact in legal medicine, for it sanctions the possibility of an individual removing to a considerable distance after the receipt of a mortal wound, and being found dead some hours or days after. As an illustration of this fact, involving a question of life or death, we may adduce the following case mentioned by Dr. Dunlop, (Beck, by Darwall, p. 335,) as having been tried in Glasgow in the year 1819.

The keeper of a house of bad fame in Greenock, was indicted for the murder of a sailor by shooting him through the chest. It appeared from the evidence of the medical witnesses, that the auricles and part of the aorta next the heart were shattered to atoms by the slugs and brass nails with which the piece was charged, and in their opinion he must have dropped down dead the moment he received the shot; therefore, as the body was found in the street, and the door of the house was eighteen feet up an entry, it followed that the prisoner must have run after him into the street, and there shot him. For the prisoner, it was urged and proved that he had shot him through the door of his own house, which he was attempting to enter by force. And besides direct testimony to this effect from those within the house, and from a lad who was along with the deceased at the time, it came out in evidence that there was a stream of blood from the door of the house to the spot where the body was found, which could not have run from the body towards the house, as the threshold of the door was on a higher level than the pavement of the street. On this evidence the prisoner was acquitted. In judging of wounds of this organ, the size and shape of the instrument, and the depth and direction of the wound, are to be considered. The extent of the wound, as we have already stated, makes a great difference in the chance of recovery. But there is one circumstance which is not very easily explained, that is, how so large a wound as a musket-ball must make, permits life to be carried on for an instant. It is generally admitted that wounds of the aorta and vena cava are mortal; but this must be taken with limitation, for very small punctured wounds may certainly be inflicted without involving the life of the individual. What the extent of a wound necessary to cause death is, we cannot precisely say; but we can conceive the possibility of these vessels being pierced with an acupuncture needle with impunity.

The thoracic duct, from the important function it performs, can scarcely be wounded without inducing fatal consequences. This arises as well from the extravasation of its contents into the thorax, as from the interruption to the supply of nutriment to the body. Wounds of the diaphragm have been generally divided into those of its tendinous and of its muscular portions; but the distinction is useless, for it is not ascertained that injuries of one portion are less serious than those of the other; and it is certain that both are highly dangerous. There is a source of danger connected with wounds of this muscle, which it is well to bear in mind, and that is, the possibility of some of the abdominal viscera being pushed through the opening, and there being strangulated. Dr. Gordon Smith (Principles of Forensic Medicine, p. 279) relates a case of this sort. A sharp-pointd weapon had passed through the diaphragm, notwithstanding which the patient made a rapid and perfect recovery to all appearance. At the end of about three months, he died from strangulated hernia of the stomach, which had passed through the wound of the diaphragm into the thorax.

Wounds of the abdomen, however slight, provided they penetrate its cavity, must be considered dangerous, from the great tendency of its lining membrane to take on inflammatory action, and the rapidity with which inflammation runs over its surface when once established. Penetrating wounds may also strike one or more of the viscera contained in the abdomen, in which case the danger arises both from the lesion of the organ itself involving derangement of structure and function, and from the effusion of its contents into the abdominal cavity.

Wounds of the stomach are to be deemed highly dangerous, although there has been great diversity of opinion concerning their mortality. Dr. Beck takes notice of the declared opinions of some of the German colleges upon this point. A wound of the stomach was declared only accidentally mortal by the faculty of Giessen, and absolutely mortal by the college at Frankfort; while, in another case, a wound was considered mortal by the faculty at Leipsic, and not so by that of Helmstadt and Wirtemburg. The fact is, that very extraordinary escapes have followed wounds of this viscus. The writer recollects the case of a pauper in the house of industry in Dublin, about the year 1814, who had received a wound of the stomach some years previously, from which he recovered, with a fistulous opening in the side, of considerable size, communicating with the stomach. He kept this plugged with a tent of lint or tow, and, to gratify visitors, he would, for the reward of a few pence, take a large drink of milk or other fluid, and withdrawing the plug, suffer it to flow out through the external opening. This and similar instances tend to show that wounds of the stomach inflicted from without, although highly dangerous, are not absolutely mortal. But we can scarcely say the same of rupture of the stomach caused by a blow or contusion on the part, inasmuch as the contents have then no chance of an external outlet, and must be poured into the peritoneal cavity. While upon this subject, we may remark that rupture of the stomach may take place without external violence, and it then commonly causes death after a train of symptoms that closely resemble the effects of the irritant poisons. This accident usually occurs from the efforts to discharge, by vomiting, the contents of an over-filled stomach. When the organ is in this condition, it is carried forward, and makes an abrupt turn on the lower end of the œsophagus, which acts as a valve, and opposes the exit of the contained matters. A striking case of this kind is related by Dr. Lallemand. (Inaug. Dis. Paris, 1818. Christison on Poisons, first edition, p. 88.) A woman convalescent from a long attack of dyspepsia, being desirous to make amends for her long privations as to diet, ate one day to satiety. Ere long she was seized with a sense of weight in the stomach, nausea, and fruitless efforts to vomit. Then she all at once uttered a piercing shriek, and exclaimed that she felt her stomach tearing open; afterwards she ceased to make efforts to vomit, soon became insensible, and in the course of the night she expired. In the fore part of the stomach there was a laceration five inches long, and a great deal of half-digested food had escaped into the cavity of the abdomen. Professor Barzelotti (Medicina legale, ii. p. 22) notices a case in which the rupture was caused, not by the accumulation of food, but by the accumulation of gases arising from depraved digestion, similar to what arises in cows which have eaten largely of clover. In these cases the train of symptoms would lead one to suspect the administration of an irritant poison, but sometimes death is instantaneous. Dr. Christison (loc. cit.) mentions the case of a coal-heaver in London, who, while attempting to raise a heavy weight, suddenly cried out, clapped his hands over his stomach, drew two deep sighs, and died on the spot. On dissection, a lacerated hole was found in the stomach, big enough to admit the thumb, and the stomach did not contain any food. These cases show the great danger arising from simple rupture of the stomach; but the danger is still more increased when the laceration is effected by external violence; for then, besides the injury done to the organ itself, the solar plexus and semi-lunar ganglion are implicated in its effects. These parts are so essential to life, that injuries to them are sometimes followed by the most rapid and perfect death, the entire vital power appearing to be at once extinguished.

Persons suffering laceration of the intestines from blows or contusions are likewise exposed to the greatest danger; but perforated wounds do not appear of the same mortal character; and when proper treatment is pursued, very surprising recoveries have taken place. Wounds of the small intestines are said to be more dangerous than those of the larger, in consequence of the more important functions they perform, and of their being supplied with a greater number of nerves; but we cannot perceive the value of this distinction, as the principal dangers, extravasation and inflammation, are not influenced by either of these circumstances.

Individuals may be killed by wounds of the liver; although small superficial wounds, if the sufferer escapes inflammation, may not be attended by serious consequences; but more extensive and deeper injuries may cause a fatal hemorrhage, by opening some of the numerous and large blood-vessels by which that viscus is traversed. Laceration of the liver by falls is not an uncommon occurrence; and when it happens, it most commonly causes the death of the patient. Besides the injury to the liver itself, its great reservoir, the gall-bladder, is exposed to perforation and rupture; and this is an accident of the most fatal character, from the effusion of bile into the peritoneum. This secretion and the urine are the most irritating of all the fluids of the body, and never fail to cause death when suffered to escape into the belly. Wounds of the urinary bladder, therefore, except at the part uncovered by the peritoneum, are of the most fatal kind.

Before we leave this part of our subject, we wish to make some remarks upon a form of accident which has been long known and described, but about which very vague and unphilosophical notions were entertained;—we allude to what have been termed wind-contusions. It is not rare to find upon a field of battle dead bodies preserving their form and the integrity of their surface, and not presenting externally any lesion by which death can be accounted for; but if the body be opened, some of the viscera of the thorax or abdomen are found bruised and ruptured, and an extravasation of black fluid blood or of the contents of the stomach and intestines. When the nature and extent of these internal lesions are considered, it is evident that death must have been instantaneous, and the vital powers so quickly and completely destroyed, that there has not been time sufficient to allow of the infiltration of blood into the cutaneous tissue, so as to produce ecchymosis. As this kind of injury has been observed particularly after battles, it was imagined that death was caused by the wind of cannon-balls, that is, by the compression of the air caused by the passage of the shot in the vicinity of the individual. But when we consider the fluidity and elasticity of the atmosphere, and the little resistance it makes to the passage of bodies through it, we must perceive that this explanation is untenable; for the unconfined air never can be compressed to such a point as to become a mass capable of contusing or even giving a severe shock to our bodies. It is now generally believed that these lesions are caused by the contact of the cannon-shot itself, when towards the close of its trajet. For the first moment of projection, when the force is greatest, it pierces, tears, and carries off all that occurs in the line of its direction; but when it approaches the end of its course, and its velocity is considerably diminished, it loses the power of producing these effects, and as the skin is supple and extensible, and the parietes of the thorax and abdomen are flexible and elastic, and protected by clothing, they yield to the impetus without tearing, and resume their original form as soon as the compressing force ceases to act. But the parts which lie deeper than the parietes, and whose tissue is less flexible, and supported by bone, experience necessarily the whole force of the compression, and are thus contused, bruised, or, in some instances, reduced to a complete pulp. Any doubt of the validity of this explanation is removed by a reference to reports of cases of injuries not dependent on fire-arms, in which the same laceration and contusion of the viscera of the abdomen and thorax have been found without any appearance of external injury. Chaussier relates the case of a strong man, thirty years of age, who, while driving a cart heavily laden with stones, attempted to get on the back of one of the horses, and falling in the endeavour, the wheel passed slowly over his left shoulder, crossing the clavicle near the sternum, and continuing its course obliquely over the entire left side of the thorax. The body was found the following morning on the road, lying on the back with the track of the wheel marked on the clothes by a broad streak of mud. Nevertheless, on stripping the body, there was no appearance on its exterior that could lead to a knowledge of the cause of death. However, after removing the integuments and muscles of the thorax, it was found that the clavicle was torn from the sternum, and all the ribs of the left side were fractured, but there was no ecchymosis under the skin or round the fractures. The first rib was broken in one place near the sternum, but all the rest in two, about three inches apart, which corresponded with the breadth of the wheel. These fractures were not complete, but were limited to the inner surface. On opening the thorax, the pericardium was found distended with coagulated blood, and a large rent was discovered in the left auricle of the heart. From this it is evident that pressure by the passage of a heavy body may cause bruising or rupture of the internal parts, without leaving any appearance of its action on the exterior; and in like manner those great contusions and sudden deaths, without external mark of violence, observed after actions, are to be ascribed to the size and weight of cannon-shot striking the body with diminished velocity.

We do not deem it necessary to dwell upon wounds of the extremities, as the danger of speedy death in these cases depends upon the escape of blood from some of the great blood-vessels implicated in the injury, a complication which is easily detected by dissection. But there is a form of injury connected with this part of our subject on which it is necessary to make a few observations. We allude to wounds of the external parts of generation in the female, which may prove fatal by excessive hemorrhage; the peculiar structure of the parts, consisting of erectile tissue, which is very vascular, giving rise to a continued, steady, though not very rapid flow of blood. In illustration of this point we may refer to two cases related by Mr. Watson. The first is that of a woman who resided near Edinburgh, whose husband was tried and convicted of having murdered her in the year 1826. "The body," says Mr. Watson, "of this unfortunate person was inspected by Mr. Newbigging and myself. We were informed of her having died suddenly. She seemed to be about fifty years of age, of stout form, of very low rank, having lived in a small, dirty, ill-furnished house, having only some shavings and straw upon the floor, covered with a rug for a bed. The clothes in contact with the private parts were stained with blood. No appearance of injury could be perceived on any part of the body externally; but upon separating the labia pudendi, a wound about an inch and a quarter in length was observed upon the inner side of the right nympha. This wound was evidently recent, its surface being covered with coagulated blood. Externally it consisted of a remarkably clean, straight incision parallel with the nympha. Internally the finger could be introduced in four different directions to the depth of about two and a quarter inches in each: upwards and backwards towards the division of the iliac artery; backwards towards the tuberosity of the ischium; laterally towards the hip-joint; and upwards towards the mons veneris. In each direction the wound was of nearly the same diameter, which readily admitted the finger, and had distinctly an obtuse termination. By injecting warm water into the large vessels, we found that none of them had been wounded, and the penetrating instrument seemed to have been forced only through the cellular tissue. The weapon had passed up to the peritoneum at the right side of the pelvis, under which there was a considerable effusion of blood, but had not penetrated it. Another very small, but also very clean external incision was observed at the side of that above described. The cavities of the cranium, thorax, and abdomen, were each examined, and their contents found to be quite healthy and natural. The hemorrhage, therefore, which had taken place from the wound was the only cause which we could assign for her death, and this we knew from the nature and structure (erectile spongy tissue) of the parts cut, must have been profuse." It was proved on the trial that the wound was inflicted by a razor.

The second case is very similar to that first described: it occurred in the person of a woman who lived in Edinburgh, and whose sudden death was occasioned by a wound received on the morning of the 1st of January, 1831. This case was examined by Mr. Mitchelhill and Mr. Watson. They found the body dressed in the ordinary day-clothes, which they removed carefully, and observed no wound or tear on them, but the lower parts were drenched with blood. They then discovered that the hemorrhage had proceeded from a wound of the left labium pudendi, consisting of a very clean incision about three quarters of an inch in length, parallel with the margin of the labium. When the finger was introduced into this wound, it entered a bloody cavity sufficient to have contained a small hen's egg, and from this cavity the finger could be passed upwards towards the symphisis pubis, downwards towards the perineum, and backwards by the side of the vagina and rectum. Its greatest depth at any of these places was between two and three inches. When the internal part of the wound was laid open, the divided orifices of several pretty large arteries and veins were seen, and particularly the divided extremities of the large artery going to the clitoris. By the evidence adduced at the trial of two young men, brothers, for the murder of this woman, it was obvious she had received a wound at the first floor of a common stair, almost immediately after which she was precipitated headlong to the bottom of the stair. In reference to these cases Mr. Watson remarks, "In both, this part of the body seems to have been selected by the murderers to effect their design secretly; for in both, but particularly in the first, the wound was concealed to a superficial observer; and they may have had an idea, from the frequency of flooding in females, that their death might have been supposed to have happened either from this cause or by accidentally injuring themselves by sitting down upon some sharp body. For it is a curious fact that in both cases the probable murderers were the first to go for medical aid to the deceased.

Circumstances affecting the medico-legal character of wounds.— So far we have considered wounds according to the consequences that usually attend them; but the medical jurist should ever bear in mind the fact, that injuries, naturally belonging to the class of slight wounds, may acquire the character of severe, dangerous, or mortal, from the co-operation of circumstances more or less extraneous, and, therefore, relieving the inflictor more or less from responsibility. We have already alluded to the memorable aphorism of Mr. Hobbs, that there never was a wound but it might prove mortal. Let us now inquire into those circumstances that are thus capable of altering the medico-legal character of wounds: these are age, sex, constitutional peculiarities, previous injury or disease, subsequent injury or disease; malum regimen.

Of *age*, it may be said that adult age is on the whole the most favourable to recovery from injuries: of this we have a very striking example in the case of burns, the effects of which are much more severely felt by young subjects, and the mortality attending them is greater in this class than in persons who have reached adult age. Fractures may, perhaps, form an exception to this, as it is observed that this species of injury is less fatal in children.

Sex is a circumstance of aggravation in the case of blows on the breast of a female. This organ being in early life endowed with peculiar sensibility, and in later years being prone to take on cancerous action when excited by injury, is naturally a very vulnerable part, and a comparatively trifling blow in this situation, may be followed by the severest effects. In like manner, an injury on the abdomen of a pregnant woman must be regarded as a more dangerous accident than the same force applied under different circumstances.

Constitutional peculiarities do not form a good exculpatory plea unless the wound be slight. They are of two kinds, constitutional infirmities and malformation. Slight wounds may be rendered dangerous, and even mortal, from an extreme irritability of the nervous system. We see this in the different effects produced on different patients by surgical operations, some bearing with fortitude what others unaccountably sink under. The scrofulous diathesis and venereal taint influence the result of wounds, and diseases of the bones and joints have succeeded in such constitutions to injuries which would have been of little consequence in sound ones. The hemorrheal diathesis is one calculated to increase the danger of slight wounds in a remarkable manner, some striking examples of which have been already mentioned. Original or accidental malformation may likewise contribute to the fatal effects of a slight injury. Thus transposition of the viscera may bring an organ within reach of a wound that might have been otherwise harmless. A very remarkable instance of such malformation is preserved in the museum of the Dublin College of Surgeons. The subject was a woman advanced in life, who died in one of the hospitals of the House of Industry, and who had never given any indication during life of her peculiar formation. On examination of the body after death, all the viscera of the thorax and abdomen were found transposed. The heart was at the right side, the liver at the left, the stomach and spleen at the right, the cœcum in the left iliac fossa, and the sigmoid flexure of the colon in the right, and all the blood-vessels were transposed to correspond. But besides such a general transposition, there may be a partial malposition. Thus, an artery, usually deeply-seated may take a superficial course, and prove a source of danger in case of a slight wound inflicted in that situation. A case in which death occurred in consequence of malposition of an artery, happened in the hands of one of the most experienced surgeons in Dublin some years ago. A fish-bone stuck in the throat of an individual, who applied to the gentleman alluded to for relief. A probang was passed down the œsophagus, when suddenly an immense gush of blood took place from the mouth of the patient, and he dropped dead in his hands. On examining the body to ascertain the cause of this unexpected fatality, it was found that the arteria innominata, instead of following its usual course in front of the trachea, had dipped down between it and the œsophagus, just at the spot where the fish-bone had lodged, the point of which had been forced by the probang through the œsophagus into the artery, and thus caused the death of the patient. Besides these congenital malformations, there may be accidental displacement of a viscus, as in hernia, by which a blow in certain situations will be made more dangerous.

Previous injury or disease is a plea sometimes set up in extenuation of guilt, but it is a feeble one, and in fact untenable if the injury is of a usually dangerous character, or has manifestly accelerated the death of the individual. It may, however, be used with advantage if the injury was slight; but the degree of weight that should be allowed to it in law is sometimes very difficult of decision. The chief questions on the subject are, 1st, Was the new injury adequate to cause serious mischief in ordinary cases? 2d, Whether did the injury, or the previous disease or accident, occasion death? 3d, Did the alleged previous harm really exist, or was it the consequence of the injury? Chaussier relates the case of a boy who was killed by a very gentle stroke of a switch upon the head, which in ordinary cases would have caused no mischief, but proved fatal in this in consequence of previous absorption of the skull at the particular part struck. An interesting illustration of the second question has already been quoted from the same author, in which death was produced by the bursting of an internal aneurism. Cases that come under our third head are very common; we will content ourselves by quoting one by Dr. Klapp of Philadelphia. (American Medical Recorder, v. i. p. 156, and Beck, by Darwall, p. 352.) An individual in that city, who was in habits of intemperance, engaged in a brawl, received an injury, and died thirty-eight hours after the affray. He walked and spoke after receiving the injury, and even drank part of a pint of spirits, but was shortly seized with insensibility, dilated pupils, oppressed breathing, and died without any return of sense. The bone and the brain beneath the injured part were examined and found natural. The mucous membrane of the cardia and the upper part of the stomach were greatly inflamed; the other parts were not diseased. Before the court, Drs. Hartshorn and Klapp gave it as their opinion that the injury to the head had not been the cause of death, and that there was no appearance of a blow on or near the region of the stomach. A verdict of acquittal was the result. But supposing the injury to be of such a kind as would alone prove fatal, then the second question arises, Whether did the injury or the previous disease cause death? There are circumstances which may render this a nice question to answer: thus, for instance, the disease and the injury may cause the same symptoms and appearances, as in the case of apoplexy and extravasation of blood from a blow. In cases of this kind confusion and difficulty are sure to occur, when the investigation is made according to the Continental system; but in these countries the animus with which the injury was inflicted being the chief object sought after, the medical witness is saved from the nice distinctions laid down in foreign authors.

Subsequent injury or disease may also alter the medico-legal character of injuries. It may happen that a disease totally unconnected with the effects of an injury, may invade a person who has received a wound, and carry him off. This is a case that sometimes creates great difficulty. Thus, a typhous fever may attack an individual labouring under a wound of the head, or spontaneous pleurisy may occur after injury to the chest; in both of which cases it is evident that great obscurity must exist. We recollect the case of a boy who was admitted into the Richmond Hospital, Dublin, labouring under a wound of the head with a small depressed fracture of the right parietal bone. He went on well for some days, when headach came on, flushed countenance, fast and hard pulse, dry and burning skin, and thirst with sickness of stomach. It was at once supposed that inflammation of the brain had set in, and preparations were making for trephining him, when attention was accidentally turned to his right arm, from which he had been bled on the day of his admission, and in it, in the neighbourhood of the puncture and spreading up the arm under the fascia, a large collection of matter was discovered, on the liberation of which, all the bad symptoms gradually disappeared, and the boy recovered well without any operation. This was a case in which a subsequent disease put on the appearance of the worst consequences of the injury, and was at first mistaken for them.

Zacchias relates an instance illustrative of the difficulty that may occur in these cases. During a period in which the plague raged at Rome, a man received a wound on the head, which denuded the bone, but left no fracture. The wound appeared favourable for the first three days; but at the termination of that period a fever came on, accompanied with bilious vomiting and violent inflammation of the wounded part. On the fourth day the wound was gangrenous, petechiæ and buboes occurred, and he died on the sixth. It appeared afterwards that he had been visited during the first two days of his illness by a friend, who had died of the plague on the fourth day after communicating the disease to the wounded person. Tetanus is a consequence of wounds which must occur to every one as likely to alter their medico-legal character. A case occurred a few years ago in England, in which the supervention of this disease upon a slight injury had a great influence upon the fate of a prisoner. A gentleman fired a gun, loaded with small shot, at a boy whom he found trespassing on his ground. He wounded him slightly in the leg, and the boy appeared going on well until he was attacked with tetanus, of which disease he died. The gentleman was tried, found guilty of murder, and executed. This case forms a good example of what has just been stated respecting the English practice in such cases; for if the wound had been inflicted with a stick or whip, or other implement, it is almost certain that a verdict of murder would not have been returned against the prisoner; but a gun having been used, made it appear that the intent was to do some grievous bodily harm, and the heaviest penalty of the law was accordingly inflicted.

Malum regimen, or improper treatment, often constitutes a very strong exculpatory plea, as by it the character of wounds may be materially altered for the worse. Accidental or inevitable want of skilful attendance is not a valid plea; but if the omission was intentional or avoidable, it takes off the responsibility of the inflictor in a great degree. If a patient should refuse to submit to proper treatment, or should persevere in the use of forbidden articles of food, or should expose himself to cold or a vitiated atmosphere, it is plain that he must contribute to place himself in a more unfavourable position, the result of which can only be charged on himself. On the part of the medical attendant, misgovernment may arise either from negligence or bad treatment, by either of which the danger of a wounded person may be greatly aggravated. "In general," says Dr. Beck, "when a dissection proves that no wound mortal in its nature has been received, and when none of the circumstances already enumerated can be urged as causing its fatality, the death of the patient should be attributed to the surgical attendant rather than to the author of the wound, provided it can be proved that he neglected the sick person, or maltreated him by leaving foreign bodies in the wound which might have been taken away; by not suppressing hemorrhage; by not evacuating collections of pus when necessary; by employing tents unnecessarily; by neglecting or hurrying operations; or by not causing the proper regimen to be observed." (Med. Jur. by Darwall, p. 327, [or Amer. edit. ii. 235 : Philad. 1838.]

In cases where bodies are found dead from wounds or bruises, a very important question arises which the medical jurist is frequently called upon to solve,—that is, are the wounds the result of suicide, of accident, or of murder? In the greater number of cases in which our assistance is required, the circumstances of the case are so well known, or can be so proved by witnesses, that there can be no doubt of the cause of injury or of the true author of it. But there are cases in which, to fulfil the objects of justice, it is necessary to determine whether the wounds inflicted on an individual were by himself or others. The solution of this question is always delicate, often embarrassing, and very difficult. The circumstances to be attended to in this inquiry are,—first, the seat of the wounds; secondly, their direction; thirdly, the probable weapon used. There are few wounds that one person can inflict upon another that may not be accomplished by an individual on himself. Some, however, form an exception on account of their extreme difficulty. For instance, it would be hard to believe that a wound with a sharp-pointed instrument in the spinal marrow was inflicted by the individual himself; and in death from fire-arms, wounds inflicted from behind can scarcely be supposed to have been voluntarily effected. Incised wounds are seldom inflicted except on the throat, for the purpose of suicide; but instances have occurred where individuals have resorted to wounds of the extremities and amputation of the penis for this purpose. A case occurred recently within our own knowledge, where the suicide, having failed, as often happens, to destroy himself by cutting his throat, deliberately bared his left arm, and cut it across to the bone, above the elbow, dividing the brachial artery, from which he bled to death. The circumstance of fire-arms being discharged in the mouth of an individual is sufficient to warrant the belief that it was not done by the hand of another. Thus, attention to the seat of the wound will often determine whether it is the result of accident, suicide, or homicide, and will throw light upon the evidence of witnesses as to the circumstances under which the injury was inflicted. The direction of the wound will often likewise determine the intent, and the question of suicide or homicide. When a wound does not pass through the body, there will be little difficulty in ascertaining the direction in which it came and in which it passes. In a case of supposed suicide by means of a knife or pistol, the course of the wound should be examined, whether it be upwards or downwards, and the length of the arm should be compared with the situation and direction of the injury. It should be ascertained whether the right or left hand has been used; and as the former is that most commonly employed, the direction should correspond with it; but if the direction corresponds with the left, it should be inquired whether the deceased were left-handed. When a wound is alleged to have been inflicted by accident, we may inquire into the probability of the statement by comparing the stature of the body with that of the inflictor, and the relative position of the two at the moment the wound was received. In fact, a stab given by an individual of small stature to one of greater size is naturally directed from below upwards, and the contrary if it is the larger of the two who has inflicted it. An example of this occurred some years ago at Marseilles, (Méd. Lég. t. iii. p. 195,) in two men of different height, who fought a duel with swords on a public walk. The weapon of each of the combatants reached the heart of the other at the same moment, and they fell dead together. Their bodies being examined, it was found that the wound given by the small man was directed from below upwards, and that by the larger from above downwards. The situation and mode in which a wound is inflicted will often point out the intention of the perpetrator. Fodéré (Méd. Lég. t. iii. p. 196) relates a case illustrative of this point. A miller was assassinated at his own door by a butcher, who pretended that he had no intention of killing him, but had only threatened him with his knife in consequence of some maltreatment which he had received; that the miller renewed the attack, and in attempting to pursue him, made a false step and had fallen on the weapon. A single external wound, which led downwards to two wounds of the left ventricle of the heart, separated from each other by an interval of two lines, showed that the accused had employed the same method to destroy his victim as that used by butchers in that country to kill cattle; that is, after having driven the knife into the heart, they withdraw it some distance, and replunge it, so as to make a second internal wound. Thus the direction of the wound compared with the respective statures of the two adversaries, (the butcher being much smaller than the miller,) proved that the blow had been inflicted obliquely from above downwards, that is, whilst the miller was sitting at his door, and not by a fall after getting on his feet, in which case the wound must have taken an opposite direction.

In the case of wounds from fire-arms perforating the body, different opinions have been formed as to whether this circumstance should determine the distance at which the shot was fired; and at first we might be led to suppose that if a pistol-bullet passed through, the instrument from which it was discharged must have been very near. But this is found to depend so much upon the strength of the charge, the direction of the ball, and the resistance offered by the parts of the body, that we cannot venture to draw any conclusion from it. It is, however, of importance to be able to discriminate between the entrance and exit wound, as a means of ascertaining the direction of the shot. That made on entering is smaller than the other, and has its edges inverted and depressed, while the latter is much larger, with ragged, everted, and uneven edges,—a circumstance depending upon the direction in which the force is applied to the skin, as well as upon the diminished velocity of the ball. When flat bones are perforated by balls, the same difference in the size and appearance of the two openings is to be observed. A trial, in which the defence rested upon the difference between the wounds, took place a few years ago in Kent, and is recorded by Dr. Gordon Smith. (Principles of Forensic Medicine, p. 290.) An officer in the preventive service was indicted for the murder of a man who was shot in the night, under circumstances of a suspicious nature as to his pursuit at the time. There was no doubt that he was in company with a party of smugglers, and came by his death accidentally. He was retreating before the prisoner, who tripped, and in the fall his gun went off. It seems that, on the other hand, several shots were fired on the part of the smugglers in their retreat, and that the deceased was killed by one of them. This appeared from the testimony of a navy surgeon of considerable experience, who examined the body. He found the wound in the upper part of the groin much smaller than that in the lower part of the buttock, which was twice or three times the size of the former, and was ragged and uneven. Fragments of the bone were likewise felt at the hinder opening, but none in the cavity of the pelvis. From these appearances he gave his opinion that the ball had entered in front, and had consequently come from his own party.

The probable weapon with which a wound was inflicted will often assist in disclosing the true nature of the accident. The singularity of shape that some wounds present, and the comparison that may be made between them and that of different instruments, has sometimes served to illuminate obscure cases. Such is the case related by Desgranges, and quoted by Fodéré, of an individual, who, having got drunk in a pot-house, left it to return home at eleven o'clock at night, the ground being covered with snow. He was found dead the following morning, beside a ditch near his own house. Desgranges examined the body, which at first offered no trace of wound, bruise, or violence; but on turning the head from left to right, an oblique wound was discovered, scarcely three quarters of an inch in extent, under the base of the lower jaw, and about the height of the larynx. The little finger introduced into this wound showed it to be wider and more extensive within than appeared from the external incision. The clothes of the deceased were stained with blood, and there was a large quantity poured out on the snow. It appeared that this wound had been inflicted with an auger, which the deceased had carried out of the pot-house under his arm, with the point foremost, and upon which he, being drunk and hardly able to walk, had fallen. This instrument was found lying beside him covered with dry blood, having been extricated by the deceased from the wound, but not before it had wounded the left carotid artery.

While upon this point, we think it well to insert the declaration of Sir Everard Home, relative to the remarkable case of the death of Sellis, a servant of the Duke of Cumberland, and the simultaneous injury received by his Royal Highness. Sir Everard's declaration seems to indicate that Sellis had committed suicide after attempting the life of the duke. "I visited the duke," he says, "upon his being wounded, and found my way from the great hall to his apartment by the traces of blood which were left on the passage and staircase. I found him on the bed, still bleeding, his shirt deluged with blood, and the drapery above the pillow sprinkled with blood from a wounded artery, which puts on an appearance that cannot be mistaken by those who have seen it. This could not have happened had not the head been lying on the pillow when it was wounded. The night-riband, which was wadded, the cap, scalp, and skull, were obliquely divided, so that the pulsations of the arteries of the brain could be distinguished." "While dressing these wounds, a report came that Sellis was dead. I went to his apartment, found the body lying on its side on the bed, without the coat and neckcloth, the throat cut so effectually that he could not have survived a minute or two. The length and direction of the wound were such as left no doubt of its being given by his own hand; any struggle would have made it irregular. He had not even changed his position: his hands lay as they do in a person who has fainted. They had no marks of violence upon them. His coat hung upon a chair out of the reach of blood from the bed; the sleeve from the wrist to the shoulder was sprinkled with blood, quite dry, evidently from a wounded artery, and from such kind of sprinkling the assassin of the duke could not escape." (Edin. Ann. Regist. v. vi. pt. ii. p. 19, and Beck by Darwall, p. 308, [or Amer. edit. ii. 93: Philad. 1838.])

Some light may be thrown upon cases of death from fire-arms by attention to collateral circumstances. Thus, in some instances the crime has been brought home to an individual by means of the wadding employed. A case of this kind occurred in France in 1818, and a similar one more recently in England; in both of which the wadding was examined, and discovered to have been torn from paper found in the possession of the murderer. If the ball is discovered, a comparison of it with the gun or pistol from which it is supposed to have been fired may assist in the inquiry. Thus, in a case of alleged suicide, in which a pistol was found beside the body, on comparing the ball with the barrel of it, it was found too large to have entered it, and so the question of suicide was set at rest, and attention was directed to detect the murderer. If a flint pistol have been employed for the purpose of suicide, it has been imagined that the discoloration of the fingers from the combustion of the priming would confirm the case as one of suicide; but this mark, besides being capable of imitation by a crafty assassin, is becoming every day of less value, in consequence of the general application of detonating locks to all kinds of fire-arms.

[In the Life of Sir Astley Cooper, by his Nephew, (Lond. 1843,) it is mentioned as an evidence of the accuracy of observation of that eminent surgeon, that when called to see a Mr. Blight, of Deptford, who had been mortally wounded by a pistol-shot in the year 1806, he inferred from an examination of the localities that the shot must have been fired by a left-handed man. A friend of the deceased, a Mr. Patch, then unsuspected, was the only left-handed man about the premises. He was afterwards tried and convicted of the crime, and confessed his guilt before execution. (See, on all this subject, the excellent work of Mr. Taylor, entitled *A Manual of Medical Jurisprudence*: Lond. 1844.) The means of identifying spots of blood found on the body itself, on the soil, furniture, or clothes, or on the instrument with which death has been inflicted, have been investigated by MM. Lassaigne, Chevallier, Orfila, Barruel, and others. For the results of these investigations the reader is referred to the works of Devergiè, Guy, and Taylor, already cited.]

T. E. Beatty.

[DEATH, Apparent.—(See Dead, Persons found.)]

DEATH, Sudden.—(See Dead, Persons found.)

DELIRIUM.—The term delirium has either been employed without design in a vague and indefinite manner, or it has been purposely used in a very comprehensive sense, and made to include every mode and degree of mental disturbance, from the slight and difficultly-traced aberrations of the argumentative and almost rational monomaniac, to the muttering and dreamy stupor of a patient labouring under the delirium of typhoid fever. All the phases and varieties of mental alienation, whether degrees of melancholy or violent madness, the wild ravings of the drunkard and the intense reveries of the opium-eater, as well as the peculiar symptoms resulting from that oppressed and disturbed condition of the sensorium which exists in severe febrile complaints, are alike comprehended under the designation of delirium when thus extensively applied. But there are few common characters belonging to all these phenomena, and for the sake of distinct and accurate description they must be separated. Those which are associated with madness form a particular group, and they may all be set apart under that head. (See Insanity.) Under *delirium* or *febrile delirium* we shall here survey the disordered states of the sensorium and intellect which occur principally in fever and inflammatory diseases, and in some disorders affecting primarily the brain itself or its investing membranes; and we shall point out the characters which distinguish these from the other phenomena, frequently though improperly included with them under the same term.

Phenomena. — Delirium supervenes on fever during any part of its course. It occurs in the hot stage of some intermittents, but rarely makes its appearance in typhoid or continued fever until the disease has reached its height, or until the period of strong febrile action is established. It sometimes occurs suddenly, and without any previous sign of disease affecting the head; but much more frequently it is preceded by headach, throbbing of the temples, heat of the scalp, a flushed and oppressed countenance. Occasionally a slight hemorrhage from the nostrils is the harbinger of a severe attack or exacerbation of delirium. The patient is at first delirious during the short and imperfect periods of sleep, or immediately after he is roused, becoming, when fully awakened, more clear and comparatively collected; by degrees this lucid interval is less to be perceived; the individual becomes more and more incapable of reflection and mental exertion, and gradually loses the power of recognizing the persons and objects which surround him.

The phenomena of delirium, as they appear to the observer and are remembered by the patient, are like those of a feverish and incoherent dream. When, in a state of health, all voluntary control over the course of the thoughts is withdrawn and the mind given up to reverie, there is still, during our waking hours, a continual restraint exercised imperceptibly over the wanderings of the fancy by the lively consciousness of external circumstances and relations. This controlling influence is withdrawn in health by sleep, and in disease by the impaired state of the sensitive power which ushers in delirium, and which goes on increasing as that affection advances, until it terminates in coma or complete stupor. Delirium, then, appears to hold a relation to sleep and to the dreaming state which accompanies sleep, or to be itself but a species of dreaming more intense and profound.

Accordingly phenomena are recorded in many cases of delirium, bearing a remarkable analogy to some of the most striking peculiarities of dreams. In dreams the mind is carried back with vivid intensity of feeling to scenes long past, and recals, with greater accuracy than in the waking moment, minute incidents and circumstances. In delirium, when the sensitive power is nearly obliterated, the memory is occasionally, under certain modifications, surprisingly powerful and active. There are accounts on record, for example, from which it appears that persons labouring under the delirium attendant on fever, or succeeding injuries of the head, have been heard to talk in languages which they had been accustomed to speak in very early childhood, but had for a long course of years disused and totally forgotten. The case of a Welshman has been mentioned, who lay ill for some time in St. Thomas's Hospital, after an injury of the head. During the course of his illness he was heard to talk Welsh very fluently, but could not utter a word of English: when he recovered, it was ascertained that he had been absent from Wales upwards of thirty years, and had entirely forgotten his native dialect, the knowledge of which was thus revived by his disease. This statement, which was first given by Mr. Tupper, has been confirmed to the writer of this article by a personal witness. A parallel case is that of a French countess, born in Britany, who had learned the Bas Bretagne or Armorican idiom during her infancy; many years after she had forgotten it, during the delirium of a severe fever, she was heard to talk incoherently in a dialect which to the astonishment of everybody, a Welsh servant understood and interpreted. Dr. Rush, of Philadelphia, used to state that some of the old Swedish settlers in Pennsylvania, who, attaining a period of great longevity, had survived till his time, were heard in many instances during their last hours, in the almost incoherent mutterings which preceded dissolution, to talk in their native language, which, during by far the greater portion of their lives, had been entirely disused by them and forgotten.

This restoration of old and effete impressions is accompanied by another phenomenon. When the mind is thus withdrawn within itself, if we may use such an expression, and goes back to the inmost recesses in which are laid up the stores of long-concealed, but, as it seems, never to be obliterated reminiscence, it not only becomes unconscious of external circumstances, or indisposed to the perception of surrounding objects, but even loses the recent impressions of memory. Newly acquired ideas are effaced, like the immediate impressions of sensation. The knowledge of some language but lately acquired has been thus lost. A foreigner, mentioned by Mr. Abernethy, met with an injury of the head when he was twenty-seven years of age. During the delirium which ensued on this accident he could only answer questions in French, though he had previously spoken English perfectly well. He said that he was but sixteen years old, the age at which he left his own country: it is probable that the impressions received during eleven years had been effaced from his mind. After accidents which have occasioned concussion of the brain and consequent delirium, persons have lost all recollection of events which occurred during a certain period antecedent to the injury. Two gentlemen, intimately known to the writer of this article, met with accidents which occasioned to both of them severe injuries of the head. In both, concussion of the brain was followed by stupor, and afterwards by delirium, which continued some weeks. Both of these persons recovered their faculties perfectly, but each of them had permanently lost all recollection of objects and incidents which had occupied his mind for a considerable time previously to the accident.

During the state of unconsciousness as to external impressions, there is, together with excitement of memory, sometimes a considerable degree of mental activity: the mind is exercised even in forming new combinations. Many persons have been known to compose verses and speeches, and to hold conversations on abstract subjects with individuals whom they imagined to be present.

Persons labouring under delirium are at times capable of being roused by external impressions, and, when once excited, they display unexpected muscular energy, which is followed by exhaustion, but not in every instance by a relapse into delirium. Van Swieten has twice mentioned the case of a man who, under severe delirium, was roused by hearing the noises occasioned by a fire which had broken out in a neighbouring house. His incoherent muttering, which had continued for some days, ceased, and he inquired anxiously into the cause of the alarm: his delirium was cured from that time. A patient lying ill with fever some years ago, in the Bristol Infirmary, was suddenly roused by a loud peal of thunder. He started from his bed, and in a moment leaped over the beds of the patients who lay in a row opposite to him, and before anybody could lay hands on him, although in the middle of the day, when all were awake, he climbed up to an open window, twelve feet in elevation from the ground of the ward, and almost accomplished his design of throwing himself out of it. He would inevitably have been dashed to pieces if his foot had not providentially fixed upon a projecting ridge below the sill of the window, by which, as well as by one hand grasping the window-frame, he was supported until ladders were placed on the outside of the building, by which he was taken down without injury. This man afterwards recovered.

When delirium terminates fatally, it passes into coma. Sensibility becomes more and more impaired, until all conscious feeling seems to be lost. Inarticulate moaning succeeds to delirious incoherence; the patient loses in a great measure sight and hearing; the pupils become scarcely contractile, and the evacuations escape without consciousness. Patients have recovered after remaining for some time in this state, and this has happened not unfrequently in the case of young subjects. But the symptoms above detailed are more generally followed by others, which are the sure harbingers of death. These are flocci volitantes, picking the bed-clothes, convulsions, coma, with subsultus tendinum, the eyes being turned up with a falling lower eye-lid. One of these symptoms alone denotes great danger, but the aggregate announces the speedy approach of dissolution.

Diagnosis.—The diagnosis between delirium and insanity is, in practice, for the most part attended with little or no difficulty. The presence of inflammatory or typhoid fever in the former case, and its absence in the latter, is in general a sufficient indication. Mad persons have many of their functions unimpaired; they walk about, eat, drink, talk. The state of a delirious person is quite different. "The insane," says M. Georget, "have frequently the external senses and the power of voluntary motion in a healthy state; they see, hear, taste; intelligence is in very few abolished; often the mental disorder is confined to a single faculty, or to a limited number of acts dependent on a single faculty; and in those cases in which it appears to be the most extended, in intense maniacal affections for example, the faculties appear to be perverted, or insulated, and without the bond of association, but are yet far from being extinguished: the most irrational maniac talks, reasons, wills, and is not always absurd in his reasonings and actions. In the delirious, on the contrary, all the cerebral functions are severely affected; there are no correct sensations, connected ideas, or passions; no regular voluntary motions; little or no intelligence or recollection: the patient is almost a stranger to every thing that surrounds him as well as to himself." We may on the other hand observe that most insane persons have the digestive or nutritive functions in a sound state, and that they display the external appearances of health, especially after the few first days from the commencement of their insanity, and before they have shown signs of the secondary disease which is destined to bring them to their end: in delirious persons these same functions are always more or less in a state of disorder. We should in fact incur no danger of contradiction from persons who are in the habit of seeing cases of insanity, if we were to venture on the assertion that a great number of lunatics bear infinitely greater resemblance to individuals in perfect health than to patients labouring under febrile delirium.

It is of great importance not to confound these two species of mental disorder. The cerebral affection which is connected with delirium is in general severe and of short duration; it must be combated by a vigorous method of practice in order to prevent a fatal termination: madness is of long duration, and seldom or never attended with danger to existence. The latter disease seems to pursue its victims even after their recovery, by the mistrust which they inspire as well for the present as for the future; a mistrust which even extends itself to their posterity. A patient who recovers from this state is often painfully affected at finding himself in a mad-house. It would be unfortunate, on account of these considerations, to take a patient labouring under delirium for a lunatic; and in doubtful cases the physician should only describe the state of the intellectual faculties by the terms 'delirium' or 'disorder of the brain' until he has clearly recognised and is satisfied of the existence of madness.

The leading criterion between delirium and insanity is afforded by the state of the sensitive power or of the faculties of sensation and perception. Insane persons have the faculty of sensation generally unimpaired; and if they apprehend external objects to be different from what they really are, the error lies not in any disordered state of the perceptive power itself, but in the perverted judgment or false conviction of the understanding, which is so deeply rooted as even to resist the evidence afforded by the senses. An insane woman is convinced that her husband is dead; and when he actually comes to visit her, and to dispossess her of this hallucination, she insists that the devil has assumed the form of her deceased husband in order to impose upon her. A delirious person cannot distinguish one individual from another, and sometimes does not know the nurse who constantly attends him. There are, however, cases of delirium approaching somewhat to mania, in which the sensitive power is but little impaired, and some of the peculiarities of insanity show themselves. We have witnessed the display of cunning and stratagem by patients slightly delirious; artful plans laid, in order to get rid of annoyances and to gratify inclinations; a strong impression manifested by the patient that he is where he is not; a concealed suspicion that it is intended to carry him off and put him into confinement. We have known instances in which traits of this description have excited great alarm, lest what had been regarded as temporary febrile delirium might prove to be a permanent loss of reason. These fears have proved groundless. The faculties are fully restored after having been obscured under febrile delirium, with very rare exceptions. The restoration to mental vigour is, however, in some instances slow, and occupies several weeks, and even months. Facts, indeed, have occurred within our knowledge which have seemed to indicate that the intellectual faculties have been in some instances even brighter and more vigorous than ever, or at least have been exercised with greater activity, and more displayed after a recovery from febrile delirium; and a parallel observation has been made by some of the older medical writers.

Pathology. — Many practical writers have been led by observation to conclude that there are two different states of the system accompanied by delirium, in one of which the brain is not the actual seat of disease, at least to any great extent, its functions being disturbed in consequence of disease, for the most part of intense degree, existing in some distant organ; while in the other form of delirium the brain or its enveloping membranes is the seat of inflammation. It is very important, in a practical point of view, to distinguish these two affections, which may be termed *sympathetic* and *idiopathic delirium*.

1. The first-mentioned species of delirium was indistinctly described by Dr. G. Fordyce, in his minute detail of the symptoms of fever. Fordyce was of opinion that this form of delirium ought to be treated with slight anodynes and restoratives. M. Dupuytren has given to this species of disease the designation of nervous delirium: he has described it in the "Annuaire Médico-Chirurgical des Hôpitaux." He remarks "that it is frequently observed in highly susceptible or nervous individuals, who have received severe wounds, or have undergone painful operations; in those who have suffered greatly from the apprehension of undergoing operation, and in others who have made efforts beyond their physical strength to display fortitude and courage in bearing pain heroically; and, lastly, in persons who have made an attempt to commit suicide." According to M. Dupuytren's observation, cases of this description are never cured or alleviated by antiphlogistic remedies, but yield easily to the administration of narcotic injections. In the brain no traces of disease have been discovered by M. Dupuytren when he has had opportunities of investigating the morbid appearances in cases of nervous delirium. To this form of delirium, as M. Georget has observed, we must refer the various degrees of mental and sensorial disturbance which occur at the close of chronic, and even of acute diseases. Comparatively few persons die in the full possession of their faculties. But it may be observed that chronic affections do not in general excite delirium and febrile symptoms without passing into a certain degree of acuteness. May we not refer to the same head, as arising from a cause nearly analogous, the wanderings experienced by patients reduced to an extreme degree of weakness on sitting up or rising from bed, as well as the delirium which ensues on excessive evacuations of blood? Is there not in either case a defect of sanguineous stimulation, giving rise to the disorder in the intellectual processes? If we adopt the opinion of M. Broussais on the frequent existence of gastritis, and on the primitive or secondary causes of febrile action, "the stomach may be the organ which of all others exercises the greatest influence on the brain, and is generally, if not always, the cause of sympathetic delirium: but this opinion cannot be regarded as established."

The opinion that defective vascular action or vascular exinanition is a frequent cause of disorder in the functions of the brain, is a conjecture not peculiar to M. Georget. But the physiology of the brain is not sufficiently known to enable us to follow this conjecture with any thing like a legitimate theory. We only know the fact that long-continued irritation in the system, when the powers of life are giving way, frequently, if not generally, induces, previously to dissolution, more or less of disorder in the sensorial and intellectual functions. This is not the case exclusively in disorders affecting the stomach, or even more frequently than in complaints situated in other organs. Inflammations of the chest, phthisis, chronic ulcerations in the bowels occurring as the sequelæ of fever, and a variety of other disorders, often give rise to the kind of delirium here spoken of.

This species of disease has often been compared to *delirium tremens*. Its phenomena have but little resemblance to the symptoms of that complaint, whatever analogy may subsist between the unknown causes of both. They are alike in one respect, viz., as to the inutility of antiphlogistic remedies. It cannot be said that anodynes are equally serviceable in either; they are, however, in some instances of both diseases to be preferred to all other remedies.

2. Idiopathic delirium is a disease of greater importance than the secondary or sympathetic species, inasmuch as it denotes a specific condition of the brain, which requires a particular class of remedies, and which, unless removed by the timely and vigorous administration of such remedies, will speedily extinguish life. It is more marked in its symptoms, and more readily traced to its exciting causes: there is, therefore, not much difficulty in general in ascertaining its existence. This form of delirium, likewise, sometimes leaves behind it vestiges which may be discovered on dissection. Such are all the various phenomena produced by inflammatory action in the meninges and in some parts of the brain. These morbid changes are, however, seldom of great extent. They consist chiefly in vascular injection of the surface of the brain, increased hardness in its substance, effusion of fluid in the ventricles, injection of the vessels in the pia ma-

ter, serous infiltration of the same membrane: a similar condition of the arachnoid has been, as M. Georget observes, less frequently discovered. More important lesions than these have been traced in cases which combined paralytic or convulsive affections of the muscular system with delirium; but the latter cannot be considered as belonging to the disorder now under consideration.

To the idiopathic form of the disease belong,

a. Delirium following injuries of the head, fractures, concussions, wounds, and lesions of various kinds, which produce inflammation either immediately or after the first effects have subsided.

b. Delirium accompanying inflammation of the brain or its membranes, brought on by exposure to heat or cold. The effects of insolation, and of exposure to heat in furnaces or heated workshops, come under this division.

c. Delirium the result of intoxication, or of excessive doses of opium or other narcotics. We allude here, not to the state of intoxication itself, but to a more severe disease which is often the sequel of intoxication. Of this cases frequently occur in practice. A theatrical performer came home to his wife in a state of intoxication. During the whole night and a part of the next day he was supposed to be merely drunk, and no alarm was taken. As he continued to be delirious on the following day, medical assistance was required. He was still in a state much resembling that of intoxication: his head hot, face flushed, eyes red, mind confused, but without coma or paralysis. His head was shaved, and the jugular veins opened. He expired in the course of the day, and the surface of the brain was found highly injected, the white substance itself presenting abundantly bloody points. A man drank by mistake a poppy-head fomentation. He was seized with violent phrenzy, but speedily relieved and cured by means of bleeding and powerful antiphlogistic remedies.

d. Delirium occurring in erysipelas affecting the head is plainly of this kind. We have repeatedly seen the morbid phenomena denoting inflammation strikingly displayed on opening the head in cases of this description. The metastasis of dropsy, of rheumatism, and of various other diseases, when apoplexy is not the consequence, gives rise to delirium, which may be termed idiopathic, whatever organ had been affected before the disease was transferred to the brain.

e. Delirium attending continued fever is of this kind, when the head is the actual seat of the most intense diseased action. When the fever has been of that kind which some writers have termed *cephalic*, when the ordinary signs of determination to the head, or of increased vascular fulness have preceded and accompanied it, delirium may be considered in cases of fever as an inflammatory complaint. The practical consideration of this subject will be entered upon more fully under the head of FEVER. We now proceed to make some observations on the treatment of delirium.

Treatment.—The treatment of febrile delirium may be reduced to very simple principles, and these are such as are very generally understood.

Shaving the head, the application of cold water, with the admission of free air, are means often adequate to the removal of delirium as it occurs in typhoid fever. We have seen many patients brought from close and foul apartments with typhoid symptoms and labouring under delirium, who, after undergoing these simple remedies, and passing a single night in a cool, well-ventilated ward, have been found on the next morning so much improved, and so collected and free from mental disturbance, as to require no particular remedy directed to the state of the head.

Topical bleedings, viz. either by opening the temporal artery, by cupping on the head, or on the nape of the neck, or by the application of leeches to the head or round the neck, are well known to be among the most important remedies for febrile delirium.

Cold applications, by iced water or merely wetted cloths, by a stream of water passed by means of a funnel over the vertex, by ice pounded and put into a bladder or oiled skin, or by evaporating lotions, are next in point of importance to bleeding.

Blisters to the nape of the neck are often of great service. When the heat of the scalp is not great, or has been reduced, and especially when there is much stupor, or a tendency to coma, blisters are beneficially applied to the vertex.

Incisions in the scalp, made in the direction and over the sagittal suture, are of great service in cases of delirium combined with stupor, whether occurring in the course of fevers, or in affections of the head otherwise brought on. The incision should reach from the vertex to the anterior part of the hairy scalp, and be made down to the pericranium. The effect of this remedy is often an immediate relief by the bleeding which takes place. The subsequent inflammation and suppuration, the incision being kept open, are much more productive of benefit than the ordinary superficial inflammation excited by blisters, or the serous discharge from the surface of the cutis.

The writer of this article has now a patient who is making progress towards recovery, and is already almost convalescent. His improvement appears to have resulted from the means last described. He laboured under severe delirium with stupor, and had occasional fits of convulsion. His disorder was brought on by exposure to heat, his occupation being that of supplying with coal, and attending to the boiling apparatus of a steam-engine.

Purging is of great benefit in cases of idiopathic delirium, and is often sufficient alone to the removal of the disease. We shall not proceed further at present in the consideration of remedies required for the treatment of delirium. The morbid state of the brain, from which delirium arises, seldom forms a distinct and entire disease. When it occurs in fevers, the remedial treatment belongs to the therapeutics of fever: when it proceeds from injuries of the head, it comes under concussion of the brain, or fracture or wounds of the scalp, &c. To articles on these several subjects in the present work, or to distinct treatises, we must refer our readers for more particular details.

J. C. PRICHARD.

DELIRIUM TREMENS. Amongst the numerous maladies which are the results of vicious indulgence, those of which the foundation is laid in the abuse of ardent spirits, and other diffusible stimuli, form a long and frightful catalogue: inflammation of the brain and its membranes; of the pleura; of the stomach; of the liver; jaundice; dropsy; diabetes; gout; mania; dyspepsia, with its manifold miseries—these are among the diseases induced by habitual intemperance; and several more might be added to the appalling recital.

Place this catalogue before the man who is beginning to acquire a taste for inebriating liquors, and he will feel alarmed; he will probably express his astonishment at the infatuation of the drunkard, and his determination to halt at once in his destructive career. Happy is it for such an one if his conviction of danger be abiding as it is powerful: unfortunately, however, it is in too many instances speedily effaced. Temptation again and again offers itself, and triumphs over repeated sober resolves, till, in the sequel, the victim persuades himself that it is absurd to forego a positive pleasure through fear of remote and contingent evils; of maladies which hundreds, more intemperate than himself, escape altogether; from many of which recovery is not uncommon; and to the visitation of which even the ascetic is liable. For some time, perhaps, he is guilty of excess only on extraordinary occasions; but, by insensible degrees, he slides into the habit of drinking deep in all companies, and, at last, of indulging even in private, and at all hours. From what is termed a pleasant companion, he degenerates into a hard drinker, and ends a complete sot.

Still he is attacked by none of the formidable diseases above enumerated, excepting dyspepsia, which he is very unwilling to ascribe to its true cause; or respecting the real source of which he is perhaps actually deceived, owing to the temporary relief which the application of fresh stimuli constantly affords him. His bane and antidote are one and the same. But he who abandons himself to incessant or immoderate potations should know, that if he escapes those diseases which once created such alarm in his mind, he is yet obnoxious to one not less formidable, which sometimes manifests itself rather suddenly, and speedily destroys the patient; sometimes creeping on by slow and almost imperceptible degrees, though it may not prove immediately fatal, may still leave him in a lamentable state of debility both of body and mind, and materially abridge the term of his existence.

This disease has received a variety of appellations. It has been called *brain fever*, *a peculiar disorder of drunkards*, *delirium et mania è potu*, [*œnomania*, *mania è temulentiâ*, *delirium potatorum*, *d. tremifaciens*,] *delirium ebriositutis*, *erethismus ebriosorum*, *encéphalopathie crapuleuse*, [*folie des ivrognes*,] *delirium tremens*. The latter designation is here adopted, not as being altogether appropriate, for it is confessedly open to more than one objection. It is not perhaps quite correct to speak of a delirium as *trembling*; and the term is yet more faulty, inasmuch as tremor is not an invariable, though it be a very usual symptom. But the designation first employed by Dr. Sutton is that under which the disease has been commonly recognized since the publication of his valuable essay. That essay, though it was not the first distinct notice on our present subject, was the first which seemed to attract the attention of the profession in general to a subject previously little known. The earlier labours of Drs. Pearson and Armstrong, important as they certainly were, excited less interest. It has been observed by Dr. Blake, that traces of this affection may be discovered in the writings of ancient authors, even as far back as those of Hippocrates; and it is true that, under the heads of phrenitis, mania, &c. cases are recorded by them of which the symptoms bear an intimate resemblance to those of delirium tremens; but that those cases differed materially from others of true phrenitis or mania, seems not to have entered into the minds of the venerable fathers of medicine. Their successors, from age to age, overlooked the peculiar character of the disease. Not many years ago the most distinguished lecturers offered nothing, or, at all events, nothing precise upon the subject—excepting Dr. William Saunders. (See Sutton's Essay, p. 4—note.) Systematic writers were silent concerning it. The first distinct account of delirium tremens was from the pen of Dr. Pearson, who, it would seem, derived his information from Dr. Young, of Newcastle-upon-Tyne. Dr. Armstrong next published a paper or two upon the subject, and he was followed by Dr. Sutton. Since the appearance of his essay, the disease has again been treated of by Dr. Armstrong, in his lectures, and by several other authors of reputation, both of our own and of foreign countries: it has obtained a place in the works of Good and of Gregory, though unfortunately they differ as to its classification; the former placing it under nervous, the latter under inflammatory affections. It is now fully recognised as a peculiar disease, requiring peculiar treatment, and therefore one which it is of the utmost moment we should be able to distinguish from certain others to which it bears no inconsiderable resemblance, and with which it often has been, and probably often is, confounded, to the great detriment of the patient, as well as to the discredit and mortification of the practitioner.

In describing the phenomena of delirium tremens, we shall adopt Dr. Blake's division of the disease into three stages, not merely as convenient, but as founded upon a philosophic view of the subject. The advantages of considering delirium tremens under separate stages have not been overlooked by other authors; but Dr. Blake's arrangement seems, upon the whole, best calculated to obviate the obscurity and confusion in which its history was formerly involved, and to direct us as to our mode of treatment.

The approach of the first stage is announced by symptoms of general debility; the patient's appearance and manner undergo a certain change; his countenance is dejected and anxious; his spirits are depressed; there is frequent sighing, and oppression of the præcordia. All around him perceive that he is indisposed, though his most intimate friends may be altogether in the dark as to the nature of his malady, or its cause. If the invalid be himself questioned, he will probably maintain that nothing ails him; or, if he admits that he does not feel quite well, he will not be able to explain what is the matter with him. Upon more particular inquiry it will be discovered that his nights are restless, that his slumbers are short, and disturbed by harassing dreams; that he rises in the morning unrefreshed and languid; that his appetite is impaired, or even that he loathes food; that he is annoyed by nausea and continual vomiting; that he suffers from cramps of the extremities. Vertigo and confusion of ideas are usually present. Pain of head has been reckoned among the symptoms; but it is certainly neither a common nor a leading one. The tongue is sometimes furred, but moist; often, but not in all cases, tremulous. The bowels are generally open. The pulse, according to Dr. Blake, whose opportunities of observing the disease at its commencement have undoubtedly been ample, is invariably slow; and although other writers do not mention this remarkable slowness of pulse, they all concur in representing the pulse as by no means frequent. It is, moreover, soft and compressible; often feeble and unsteady. The temperature of the body generally is not increased, while that of the extremities is considerably below the standard of health. The hands and feet are cold and clammy; the sensation they convey to the touch resembles that observed in persons labouring under enteric inflammation. Tremors of the hands occur in most instances. Such are the principal features of the first stage of delirium tremens, and beyond this stage the disease may not proceed: by timely and judicious treatment its further progress may be arrested, and by subsequent prudence on the part of the patient its recurrence may be prevented.

Generally, however, it is succeeded, after a shorter or longer period, according to the constitution, age, and previous habits of the patient, by the second stage, or that of delirium. In young and robust subjects, whose excesses have not been of long standing, the stage of re-action or excitement will come on much more rapidly than in persons advanced in years, and whose constitutions have been broken down by long intemperance. It is during this stage that the medical attendant is most liable to fall into error. The symptoms, many of them, are so similar to those of inflammation of the brain or its membranes, that, if he is not especially upon his guard, if he allows the pathognomonic signs of the disease to escape him, his diagnosis will be incorrect and his practice unsuccessful. When the second stage is coming on, the vertigo and confusion of head are more marked; there is more decided aberration of mind; the countenance gradually assumes a wild aspect; the patient is incessantly restless; there is apparent an anxiety to perform immediately whatever is desired of him; he even anticipates your wishes, or what he supposes to be your wishes; he is peculiarly sedulous in the performance of his ordinary duties, which he goes about in a hurried immethodical manner; he is very jealous of the least interference, either by advice or otherwise, as to matters pertaining to his vocation, exerting himself painfully to prove he is quite well, yet evidently mistrusting himself. Thus, if his occupation is that of a butler, he will betray a strange solicitude about mere matter of routine; he will be in a perpetual bustle; he will commit perpetual blunders, at the expense frequently of his master and his guests: his altered countenance, uncertain step, and trembling hands, will sufficiently evince his unfitness for the duties of his situation; yet he will pertinaciously repel the proffered aid of his fellow-servants; his whole manner will much resemble that of a person on the verge of intoxication, who is excessively anxious to appear quite sober. By ordinary observers he will probably be pronounced more than half drunk, and they will recommend his being sent to his bed, under the notion that sleep will effectually restore him. But such a patient cannot sleep off his malady. He is restless; his mind wanders; he rises worse than he was before, with more symptoms of high nervous irritation. By degrees mental alienation is fully established; the patient is in a constant worry about some affairs which he fancies of great importance; some business, *generally private business*, which must be attended to. He makes violent and repeated efforts to liberate himself from restraint, that he may apply himself to these affairs; but he is not, like the decided maniac, or the man labouring under the immediate excitement of an over-dose of strong liquor, disposed to be mischievous; his exertions, though vehement, are not characterised by malignity or ill nature; he quickly forgets what is past, and, if judiciously managed, is, upon the whole, sufficiently tractable. He will generally take the medicines offered him without much difficulty, and, when exhorted to endeavour to keep quiet, will manifest, for a short time, a desire to acquiesce. He will now and then recognise those of his family and friends who are near him, and will return a rational answer to a few questions; but he very speedily relapses into his erroneous train of thought. At this period of the disease the circulation is quickened, the heat of the surface becomes greater, yet still the pulse remains small, and there is a marked difference between the temperature of the extremities and that of the rest of the body, the former continuing damp and cold. If the symptoms above-mentioned be not soon ameliorated, a sweat bursts out, copious and clammy, and occasionally, it is said, of an offensive odour. The mind becomes still more distressed; objects of the most appalling description sometimes present themselves to the patient's imagination; he will be possessed with the idea that he is persecuted by evil spirits, who are upon the point of carrying him away, or are preparing to destroy him; or he may fancy he is surrounded by assassins; and cases are recorded where the unfortunate sufferers actually expired while exerting themselves to the utmost to ward off the violence they supposed was intended them. Catastrophes so lamentable are not, however, of frequent occurrence. Various other hallucinations less frightful, though still very distressing, might be mentioned; it may, however, be sufficient to observe in a general way, that the mental bias is mostly of the melancholic kind. Sometimes the most whimsical notions arise: thus a patient will imagine that rats or mice, or other troublesome vermin are running over him, or near him; that he is employed in drawing ribands from the ends of his fingers, with numberless extravagancies of a similar nature.

When delirium is completely established, there is obstinate pervigilium, and this is a very important, indeed it has been regarded as a pathognomonic symptom of the second stage of the disease. At this period, too, the countenance assumes an aspect of extreme anxiety; the tremor of the hands and tongue is greater; the latter is more furred, but still moist; the pulse is not only small but frequent, and also indistinct, partly perhaps in consequence of the tremor and unceasing workings of the tendons of the wrists; the urine is scanty and pale; the bowels are usually confined; the dejections dark coloured; the pupils are contracted, but without intolerance of light. Still there is no indication of local pain, and when the patient is asked how he feels, he will often reply that he is quite well. These symptoms either increase in violence, and others supervening, which very nearly resemble those of the last stage of typhus, the patient dies suddenly in a convulsion; or the long-continued delirium, with subsultus tendinum, picking of the bed-clothes, &c., is succeeded by a short interval of quietude, and he expires without a struggle; or, after two or three days, or it may be a week, yawning and drowsiness come on, and sleep follows, which is generally profound and of long duration, lasting from six to twelve or eighteen hours; the patient wakes collected, and greatly refreshed, and his recovery may be looked upon as almost certain.

Such are the general symptoms of the three stages of delirium tremens, which if they be attentively considered, and viewed as a whole, will enable the medical student to perceive wherein it differs from certain other affections to which it bears a real or an apparent affinity. When he comes to the bedside, he will be in a good measure prepared to discriminate between a case of delirium tremens and one of phrenitis, mania, hypochondriasis, or typhus fever. If he be so fortunate as to be consulted early, during the first stage of the disease, he will scarcely be at a loss as to diagnosis. But it will more often happen that he is not summoned till the second stage is approaching, or until it is fully established; and then there will be more difficulty in recognizing the affection. There may be certain cognate diseases where accuracy of diagnosis is not practically essential, but in very many instances it is of the utmost importance, and on no occasion perhaps more important than when we are consulted in a case of delirium tremens. The previous habits of the patient may be unknown to the medical man; his friends may be imperfectly acquainted with them, or may endeavour to conceal them; to the superficial or the unskilful observer he may appear to be labouring under phrenitis or mania; from himself, of course, no information can be expected. Whenever, therefore, we are called to such a case, we should institute the most careful inquiry into the early symptoms of the complaint, we should endeavour to elicit from the family of the patient what has been his state, both physical and moral, for some time previous to the accession of delirium, and attentively view the previous history, so far as it may be furnished us, in connection with existing phenomena—the pulse, the countenance, the temperature of the skin, especially of the extremities, its dryness or moisture; the appearance of the tongue; the degree and kind of alienation, whether the delirium be accompanied with pain of the head or any other part, with indications of increased arterial action, or of venous congestion, or otherwise; whether it be characterized by intractable violence, or be of a more mild and manageable nature; whether there be tremors of the hands and tongue, which almost always accompany delirium tremens from the first, and do not indicate extraordinary danger, while in phrenitis they are scarcely ever present until the last stage, and are then of most unfavourable omen.

Having thus detailed the symptoms of the disease, we proceed to say a few words respecting its causes. Now the principal features which mark its first stage so commonly exhibit themselves in intemperate subjects early in the day, when they are in the state of exhaustion which is the usual consequence of a debauch, and have so frequently been observed to arise in soldiers and others, when for a time deprived of their daily quantity of liquor; that the sudden subtraction of accustomed stimuli has been regarded, by respectable authorities, as *invariably* the immediate cause of the disease. The habitual and excessive indulgence in strong liquors, or in other diffusible stimuli, has been considered as the predisposing, and the privation of them as the occasional or exciting cause of the affection.

To a somewhat whimsical theory of M. Leviellé, (Mémoires de l'Académie Royale de Méd. tom. i. Sur la Folie des Ivrognes, ou sur la Délire Tremblante,) that delirium tremens consists in exaltation of the vital powers of the brain, excited by alcoholic molecules absorbed from the surface of the stomach and bowels, and carried into the current of the circulation, it is objected by Dr. Blake, that he never saw an individual attacked with delirium tremens so long as he continued to indulge in his accustomed alcoholic potations; but that it invariably came on when old drunkards ceased for a given time (either from the effects of an excessive debauch, or from any other cause whatever, such as a wound, a fracture, or a fever,) to take their usual inebriating draughts. To overthrow M. Levielle's theory would perhaps cost little labour, but we do not consider that it is in the least degree shaken by the objection just stated; for that delirium tremens may manifest itself in individuals who have never been deprived of their accustomed stimuli, even for an hour, is most certain; as, for example, in publicans, who live in an atmosphere charged with alcohol,—who, though seldom absolutely intoxicated, are always more or less under the influence of intoxicating liquors—who are sipping from morning to night. Instances of well-marked delirium tremens occurring in such persons have fallen under our observation. Interesting cases might be cited, where, upon the patient's being at once removed beyond the sphere of temptation, recovery was rapid and complete; and others might be adduced in evidence that the habitual stimuli being obstinately persisted in, or, after a certain interval of abstinence, foolishly resumed, the disease will proceed to a fatal termination.

The delirium which comes on in persons addicted to hard drinking, several days subsequent to a wound or fracture, the traumatic delirium of

M. Dupuytren, the symptomatic delirium tremens of M. Barkhausen of Bremen, and which is relieved by ardent spirits or strong liquors of one kind or other, though it be doubtless very nearly allied to the affection which is the subject of our present inquiry, does not seem to be identical with it. In such cases the system receives a sudden and violent shock; an individual, previously perhaps in the enjoyment of robust health, accustomed to strong exercise, engaged in a laborious occupation, requiring much support, is at once confined to his bed; his habits are in a moment broken off; and no wonder that, in a few days, he falls into a state greatly resembling that of a patient in typhus — a state which absolutely requires the stimuli to which he used to resort previously to the reception of the injury. But in delirium tremens, unconnected with other disease or injury, we recognise no such immediate and overwhelming shock. The general health is first perceived to fail; it becomes more and more impaired; then come on the characteristic symptoms of the affection; and, if the habitual stimuli be continued, those symptoms progressively increase. From the first the patient passes into the second stage, from that into the third stage of the disease, and he dies. Upon the whole, it would appear that the predisposing cause of the delirium which in intemperate persons supervenes to a wound, a fracture, a fever, &c. is habitual indulgence in strong liquors, or certain other diffusible stimuli, while the sudden abstraction of such stimuli is its immediate cause. But in delirium tremens, unconnected with specific disease or accidental injury, the predisposing cause is to be sought in peculiarity of temperament, combined with other circumstances, such as mental anxiety, great and continued fatigue, &c. while habitual intemperance must be regarded as the immediate or exciting cause.

We have stated that delirium tremens is caused by the intemperate use of strong liquors, *or of certain other diffusible stimuli.* Of these latter, opium, either alone or in its various combinations, is the chief. The long-continued and free use of opium may certainly induce true delirium tremens. We have known it to be so produced, and this fact is sufficient to overthrow the theory of M. Levielle, before referred to, which would make the absorption of alcoholic molecules the exciting cause of the disease. It has also been asserted that the poison of lead, that malaria, that long fasting, will produce it; but we think, with Dr. Blake, that where delirium tremens follows emanations from lead, malaria, hunger, &c. it is only in subjects in whose constitutions the *ebriositatic diathesis* has been established by frequent excesses. When delirium from such causes occurs in persons of temperate habits, it will not present the other pathognomonic symptoms of the disease of which we are speaking.

We now arrive at an important question, one which we would gladly dispose of in a satisfactory manner, but which, we fear, must be left in obscurity—What is the pathology of delirium tremens? Dr. Armstrong, in his lectures, fairly confessed he could not satisfactorily answer the question. The affection, he said, appears to depend principally upon some condition of the nervous system with the nature of which we are unacquainted; and so he left the subject. By Dr. Gregory it is dismissed in terms sufficiently expressive of his doubts respecting it. "It appears," he says, "to have for its proximate cause a peculiarly excited state of the nervous system; but the occurrence of such symptoms in cases of extreme inanition would lead to the belief that *exhaustion of nervous power* expresses, perhaps, more accurately its intimate nature." It were easy, in this place, to descant learnedly upon cerebral irritation and disorganization; we might throw additional darkness over what is already obscure; we might pretend to explain what is unknown, by something completely unintelligible. In the absence, however, of just information, either by means of examination after death, or from any other source, we prefer acknowledging that we are very ignorant as to the pathology of delirium tremens: we do not know in what its intimate nature consists; but we do know enough to direct us as to practice; to enable us to state that in delirium tremens, uncomplicated with other serious disease, such as inflammation of some important part, unless circumstances are peculiarly unfavourable, unless the patient's constitution is extremely shattered, or he is very ill-managed, he will recover from the immediate attack. In simple delirium tremens, occurring in a subject neither far advanced in years, nor completely broken down by excess, our prognosis would be favourable.

We may now proceed to the treatment of the disease. And here we would once more strongly insist upon the importance of minute attention to its several stages; since, as each stage presents some difference with respect to symptoms, each will require modification as to the plan of treating it. It may be assumed that the disease is one of debility. Bloodletting, as a general remedy, is no longer thought of. In its first stage, of which the symptoms are entirely those of diminished energy, no practitioner would dream of bleeding, either general or topical. In this stage, (we speak, be it remembered, of delirium tremens uncomplicated with other accidental affection,) there is absolutely nothing but what would contra-indicate abstraction of blood. The employment of laxative medicines will however be needed. The bowels may not be, and indeed they usually are not, constipated, yet the stomach and collatitious viscera may fail in the due performance of their respective offices; the alvine evacuations, though not deficient, may be unhealthy. In so disordered a state of the nervous system, as Dr. Gregory observes, the secretions will probably be vitiated. Mild purgatives will commonly suffice; but if, as sometimes happens, the bowels are actually constipated, recourse must be had to more active remedies, and amongst these croton oil perhaps is entitled to especial regard, since, beyond its purgative quality, it appears to exercise a peculiar influence upon the nervous system.

While in this stage of the disease we deprecate bloodletting, and would, under ordinary circumstances, employ only mild laxatives, we would not, on the other hand, advocate a highly stimulant plan of treatment. Under such treatment patients may now and then recover; but, generally speaking, the liberal exhibition of accustomed stimuli will be likely to render the supervention of the second stage more certain, to induce more violent re-action, and to place the patient in extreme jeopardy. The accustomed stimuli should be withdrawn without hesitation. Neither wine, nor spirits, nor strong malt liquors, should be allowed at all; or at all events they should be administered only in very moderate quantities. Opium should be regarded as our chief remedy; but at this period it is not to be given in full doses, but in small ones, repeated at short intervals. If nausea is present, with disposition to vomiting, or actually vomiting, about ten drops of laudanum, or of Battley's solution, may be given every other hour in an effervescing draught; and anodyne enemata, should the stomach be very irritable, may be employed. If the stomach is retentive, and there be no nausea, the above-mentioned quantity of the opiate, with a few drops of Hoffmann's ether, or (should ether disagree, as it sometimes will, producing a distressing sense of coldness in the stomach,) a few drops of the aromatic spirit ammonia, in camphor mixture or some other grateful vehicle, will be found more advantageous than any of the stimuli to which the patient has been accustomed. The warm bath or tepid affusion should not be neglected. Even cold affusion has been recommended upon highly respectable authority; but, when we reflect upon the train of symptoms which manifest themselves in the first stage of the disease, we should scarcely, even in a young and healthy subject, venture upon the adoption of so bold a practice. Anodyne frictions may be employed to the epigastrium; the head may be shaved, and the scalp stimulated by strong volatile liniment; and a blister be applied to the nape of the neck. Emetics have been recommended by American physicians; but, as they do not appear to recognize the several stages of the affection, they leave us in ignorance as to the exact period when emetics should be given: they can scarcely be deemed applicable during its first stage; and in the second they would seem to be a doubtful remedy.

[By Dr. Joseph Klapp, of Philadelphia, the treatment of delirium tremens was made to consist almost exclusively in the employment of emetics. On them at least the main dependence was placed. When the patient is first seen by the physician, it may be advisable, in many cases, to evacuate the contents of the stomach; and at a subsequent period, the equalizing and revellent action of an emetic may be employed with advantage; but it is very questionable, whether much good can arise from the repeated administration of agents whose action may exhaust; and under such feelings, with the absence of any markedly beneficial results from their use in many cases, they are by no means generally prescribed by practitioners.]

By the judicious employment of the means just pointed out; by the adoption of what may be termed a stimulo-narcotic plan of treatment, modified according to the intensity of the symptoms, and the age, constitution, &c. of the patient; the second stage may be averted; the depressed nervous power being gently raised, the necessity for a great remedial effort of nature, for violent re-action, may be superseded; sleep may be induced, and the patient awake free from complaint.

While upon the subject of treatment in this stage of the disease, we have not touched upon diet, and for this plain reason, that the state of the stomach is usually such as not to admit of anything beyond what is essential in the way of medicine. Should, however, this stage be protracted, and the patient seem to require, or express a wish for food, any mild nourishment, such as arrow-root, sago, or broth, may be allowed him.

Should the second stage come on, depletion is, for the most part, still to be avoided; it is a remedy not to be employed but with the utmost caution. In young and vigorous subjects, and where there exists evidence of local determination, a single moderate bleeding from the arm, or the application of leeches to the temples or behind the ears, may prove useful; but the bleeding should never be large, and very seldom will it be proper to repeat it; while, generally speaking, it should be rejected as a practice which has too often done mischief, and has not unfrequently destroyed the patient. Opium is, at this period, our sheet-anchor, opium in full doses; all other remedies are of inferior importance. The object is to get down, and that speedily, what experience has proved to be generally effectual. We would recommend laudanum, say sixty minims, every hour or two; such a quantity of liquid may almost always be given without difficulty, while opium in substance may be refused, or its tincture in combination with other medicines may be obstinately rejected.

The medical attendant should watch by his patient during the exhibition of opium, and steadily persevere for several hours,—not so much regarding quantity, as the effect produced. While, however, we thus strongly insist upon the bold and free employment of opium in the second stage of delirium tremens, we would not be understood as advocating its excessive or indiscriminate exhibition. Should the remedy, after some hours, fail to produce the desired effect, we must proceed with caution, lest by pushing it too far we add to the intellectual disturbance, and to the danger of our patient. The probability, however, is, that in a few hours there will be a remission of symptoms; that tranquillity will succeed gradually to high excitement, and there will be a disposition to sleep. This disposition will sometimes be attended with slight rigors, which may alarm those who are unaware of their nature and consequences. We should then be more sparing in our administration of opiates, and allow some time to intervene between the doses. The inclination to sleep should be promoted by every means in our power; everything calculated to excite, as light, noise, &c., should of course be studiously guarded against. The first slumber may perhaps be interrupted by startings, and the patient may soon awake alarmed and distressed; but a moderate dose of opium, with some warm stimulating drink, and a kind encouraging manner on the part of the attendants, will generally be followed by a sleep more profound and of long duration, from which the patient will awake perfectly collected.

Anxious not to divert the attention of the practitioner, at this so important a period of the disease, from the one great and principal remedy, we have hitherto said nothing of other curative means; of calomel with the compound ipec. powder, in the proportions of two grains of the former to six of the latter, every two hours, till the system is affected or the disease yields; of the warm bath; of cold applications to the head; of purgatives; among which we may once more notice croton oil, either given internally, or used in the way of friction to the abdomen. These are not to be overlooked; they are valuable auxiliaries; and should opium, after a fair trial, fail us, as it occasionally will, camphor, musk, ether, ammonia, with hyoscyamus, are succedanea not to be neglected. The cautious administration, too, of alcoholic liquors, may, in such cases, be of service.

During this stage we must pay particular attention to the moral management of the patient. We must strive to obtain his confidence, to gain an ascendency over his mind without having recourse to coercive measures. As patients in delirium tremens are not usually disposed to be mischievous or malignant, physical restraint should be generally avoided: if a man is very uneasy and unquiet in bed, he may be permitted to get up; and if he is very importunate to go over his house, or is possessed with the idea that he must absolutely examine letters or papers, it will be the part of prudence to yield to his wishes, at least to a certain extent, for by so doing we shall be most likely to gain an empire over his mind; and the satisfaction of his desires, when they are not clearly improper, will probably obviate a long and painful scene of impatience and contention, and will favour the return of tranquillity, and the accession of that sleep so much to be wished for. On no account, however, should the patient be left for a moment without an experienced attendant; and it should be remembered, that although the delirium in this disease is not generally characterised by intemperate violence, instances *sometimes* occur where it very closely resembles true mania.* Where the unhappy patient manifests a strong disposition to offer violence to himself, or to those about him, every offensive weapon should be removed, and two male attendants be employed to keep the patient within bounds. We say *two* attendants, because thus the strait-waistcoat may be avoided, which, as Dr. Armstrong has observed, should never be resorted to but at the last extremity.

In one word, the treatment of patients in delirium tremens should be according to Pinel's directions in other cases of mental alienation.

To cut short the disease at this period is beyond our power; our efforts must be steadily directed towards the mitigation of urgent symptoms. Nature is now actively engaged in the work of restoration, and it is the part of the sound physician to be her discreet minister. He may direct her efforts, but he must not pretend to "give them pause." If left to herself, her operations will probably be fearfully energetic: we should endeavour to regulate the efforts she is making towards a good end.

It may, however, happen that all our exertions during the second stage of the disease will prove unavailing; that the third stage, that of tranquillity and sleep, will not be induced by any of our remedies; and that all the untoward symptoms formerly enumerated will supervene. How are we then to act? We must persist in the same general mode of treatment. We may shave the head, and apply blisters or antimonial ointment; we may apply blisters, or mustard cataplasms to the extremities; we may employ mercurial frictions; we may give powerful stimulants. It is incumbent upon us not to omit these remedies, though there exists little chance of their proving efficacious. The last symptoms are those of effusion into the ventricles, or on the surface of the brain; and such effusion to any considerable extent is almost always the forerunner of death.

When the event is more fortunate, when the immediate danger is averted, we should support the strength by moderate and frequent supplies of mild nourishment, and the judicious exhibition of diffusible stimuli, gradually diminishing the latter, and after a short time subtracting them wholly.

Having thus far conducted the patient,—having placed him in present safety,—the merely professional duty of the physician may be considered as terminated. Something, however, yet remains for him to do if he would be deemed the *neighbour* of the individual whom he has just succeeded in rescuing from extreme peril. The physician should not lose sight of the convalescent until he has seriously advised him as to future conduct. He should avail himself of the mollia tempora fandi;—gratitude, confidence in the talent of his medical attendant, a vivid sense of the danger he has escaped, a present conviction that he has nearly perished through his own folly, will probably incline the patient to listen attentively to counsel earnestly and forcibly urged, yet without the semblance of harshness or the tone of reproach. What the nature of this counsel should be, the medical man need not be informed; the prophylaxis in the disease before us is sufficiently obvious. The complete abandonment of previous habits must be inculcated; but to produce a lasting impression, the adviser must speak from the heart. He must, to adopt the language of one who was truly an ornament to his profession, "evince a genuine love of virtue, accompanied by a sincere interest in the welfare of the person to whom his counsels are addressed." Such honest counsels may be productive of an indelible impression; they may conduct to the happiest results, to moral as well as physical restoration; or should they be offered in vain, the physician will retire with at least the pleasing reflection that he has to the best of his ability fulfilled his duty.

H. W. CARTER.

[The plan of treating delirium tremens pursued by the writer, as stated elsewhere (*Practice of Medicine*, 2d edit. i. 277, Philad. 1844), has been entirely eclectic, and, in many cases, expectant, and the results have been such as to satisfy him. Under the view which he entertains of the nature of the affection,—that the irregularity of nervous action is induced by the withdrawal of an accustomed stimulus, and that the recuperative powers are, generally, entirely sufficient to bring about the necessary equalization,—he has treated the mass of the cases which have fallen under his care, without either excitants proper, or opiates. In the first instance, an emetic has been given at times, for the reasons above stated; and, afterwards, the patient has been kept in a state of tranquillity in his chamber—the intrusion of too much light and noise being prevented—and, where the stomach would retain it, gently nutritious and easily digestible diet has been prescribed; the bowels have been kept open by gentle cathartics; and this has comprised the essential part of the treatment. In time, the hallucinations have disappeared, sleep has returned, and entire restoration supervened.

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* A medical friend of the writer very nearly lost his life by the violence of a patient labouring under delirium tremens.

Under the idea, so generally prevalent, that the patient will sink unless stimulants or opium are given, if the attack be severe, the physician is apt to become alarmed, and to fly to those agents; but, should he persevere, he will find that his fears are groundless, and he will be encouraged in his course, when he reflects that, by administering either brandy or opium, he cannot infuse fresh vitality into his patient, and can only act on the excitability that is already present in the tissues. In the female lunatic asylum of the Philadelphia Hospital, the course here recommended has been advised, during the author's term of attendance as one of the physicians to the establishment, and where it has been carried out, the general result has been satisfactory, in more respects than one. It has, in the first place, restored the individual to health—not, perhaps, as rapidly as either brandy or opium, but more permanently. The term "restoration to health" is hardly, indeed, applicable to the change effected by the former remedy: the patient is merely placed in the condition in which he was before the stimulus was withdrawn; and, as he was restored by the brandy, he is apt—as before remarked—to regard it as indispensable to his healthy condition. In the "total abstinence" plan, however, the habit of drinking is broken in upon, and even if it should require a short time longer to restore the individual, there is the consolatory reflection, that delay is not useless; as every day's privation of the wonted stimulus diminishes the feeling of necessity, and the desire for it. One evidence of the good effect of the course is, that they who are dismissed cured, rarely, or never, return to the wards. This is an observation that has been made at the Philadelphia Hospital, and as it concerns paupers, it is probable, that the cures are real and permanent, for were it otherwise, they would, on subsequent attacks, be compelled, in their destitution, to seek the wards of the same excellent charity.

Under this eclectic course, it may be advisable, however, in certain cases, to administer both excitants and opiates. Where a person has been accustomed for years to the daily use of large quantities of alcohol, the nutritive functions totter under the irregular innervation, and the recuperative powers seem to be insufficient to restore the balance of nervous action. These cases are, however, uncommon. In like manner, where sleep has not recurred, after a continuance for some days of the plan above devised, a full dose of opium,—two or three grains, in the form of a soft pill,—frequently forms an excellent adjuvant. There are cases, too, in which the irritability of the stomach is so great, that no food or medicine can be retained, and the patient becomes exhausted by the irritation. A blister, applied over the pit of the stomach, and the blistered surface sprinkled with sulphate or acetate of morphia, (two to four grains at a time,) may allay the vomiting, after which such internal management may be adopted as the case may seem to demand.

Dr. M. Hall remarks, that "it becomes a serious question, whether any stimuli should be allowed" in delirium tremens. Our observation and reflection are, in the main, in favour of the negative; and the remark is applicable to the various excitant antispasmodics that are wholly trusted to by some, because the disease is characterized by tremors. All these "antispasmodics"—assafœtida, castor, &c.—are, like capsicum, mere stimulants. They are not possessed of any specific power over the disease, and are never employed by the writer, unless he is desirous of exciting a new nervous impression on the gustatory nerves, and on the nerves distributed to the lining membrane of the stomach. The same may be said of the cold shower-bath, or *douche*. The shock, or new impression, made by it, is at times salutary, but some discrimination is needed in regard to its application to those whose powers are greatly prostrated.

Admitting, then, that there may be cases which demand something more than the expectant or eclectic treatment, these cases are certainly small in number; and a careful classification, by separating those who are considered to require imperiously the use of stimulants from those who do not, cannot fail to lead to results in the highest degree satisfactory to the philanthropist: first of all, by preventing the indiscriminate treatment by alcohol adopted by many; and secondly,—as a consequence of this,—by leading to a more extensive reformation in the patients themselves. One of the writer's colleagues in the Philadelphia Hospital, Dr. Gerhard, is an energetic supporter of the method of treating the generality of cases by the free exhibition of alcoholic liquors, and, in support of it, cites the results observed in the men's wards under his care, from October 12th, 1839, to October 12th, 1840. Of 162 cases of decided delirium tremens, 87 were admitted in the first stage; 73 in the second; and two in the third: 160 cases recovered, and one remained convalescent, who is since well. "One, only, proved fatal; the patient was admitted in the third stage of the disease, and died in a few hours after his entrance: he had been treated with opium; and a box of pills, which he was taking, was sent to the hospital with him. Of course," adds Dr. Gerhard, "this apparent exception confirms the general conclusion, that the disease terminates favourably in every instance when treated according to the method recommended." Any inference, however, from a single year's observation, may be fallacious; and especially may it be questioned, when the results of a similar treatment adopted by the same observer and by others had been previously less markedly favourable. It is a well-known fact, that in certain seasons and years diseases are more severe than in others; and the circumstance, that of the 162 cases of delirium tremens, referred to by Dr. Gerhard as having been admitted in the year ending October, 1840, only two are classed in the third stage, sufficiently exhibits, that the disease must have been unusually mild. The writer has now before him a statistical account of the Women's Lunatic Asylum, at the Philadelphia Hospital, for the years 1840 and 1841, which is under the author's charge during the six months, commencing on the first of November, and ending on the first of May; and was, at that time, under his colleague, Dr. Pennock, for the other part of the year. It may be proper to add, that from November 1st, 1841, to May 1st, 1842, not a drop of alcoholic liquor was used in the treatment of delirium tremens in the Women's Asylum, although some severe cases in the third stage occurred, which, notwithstanding, terminated most satisfactorily.

Patients treated during the years 1840–41.

	Cases admitted.	Cured.	Died.
Intoxication,	44	44	0
Delirium tremens—			
1st stage,	55	55	0
2d stage,	19	19	0
3d stage,	10	9	1

The fatal case was not seen by the author. The patient died the morning after her admission, and had been treated in the city for nearly a week previously. It cannot consequently be considered, that the value of the treatment has been settled "upon a more definite basis than has yet been done." The investigations ought to be continued through a succession of years; the different methods of treatment be compared extensively, and under circumstances as nearly identical as possible, before any such conclusion can be considered established. Moreover, the results obtained by Dr. Gerhard,—successful as they were,—are not more so than those recorded by an observer already cited, who places great reliance on the treatment by emetics. In a report, made by Dr. Klapp, he states, that of 51 cases, all but one were cured without the use of a grain of opium, or a drop of alcoholic drink of any description;—the unsuccessful case died of epilepsy.

Robley Dunglison.]

[DENGUE. This singular name for a disease,—according to Dr. Dickson, of Charleston, whose essay (on Dengue, *Bell's Med. Library*, for 1839) has furnished the main material for every thing since written on the subject,—was derived from the English negroes of the Island of St. Thomas, where the disease prevailed, who called it the "*Dandy Fever*," owing to the stiff, affected gait induced in those labouring under it. When the disease occurred in Cuba, the word "Dandy" was corrupted in Spanish pronunciation into "Dunga," or "Dengue," by which it was known in the southern states. It first made its appearance in the Caribbean Islands in 1827, whence it spread over the West Indies, and in the following year to the southern coast of the United States. It prevailed in New Orleans in May and June; and in July and August affected very severely the inhabitants of Charleston; reaching Savannah in September and October. At the close of the year, it became gradually extinct, and has never since recurred. "In its brief duration," as remarked by Dr. Dickson, (*op. cit.* p. 6,) "in the suddenness of its appearance, in the rapidity of its spread, and in its total subsequent extinction, offering a striking resemblance to the *Black Death* of the fourteenth century, and the *Sweating Sickness* of the sixteenth, and several other shapes of pestilence, which have at different points of time arisen and died away, scattering among the nations horror and affright." "Happily, however," he adds, "as the record will show, it was much unlike these plagues in proportional mortality; bringing in its train infinitely less of danger and of death than of mere suffering."

Diagnosis.—The disease was generally ushered in by febrile symptoms of an inflammatory character, accompanied by a painful affection of the joints and muscles. On the second or third day, the fever declined, and with it the articular pain,—the attack terminating in a copious perspiration, occasionally attended with a rash or miliary eruption, which was esteemed, however, as only an incidental symptom. On the third or fourth day, the fever having in the meantime intermitted, more or less gastric disorder appeared, and on the fifth or sixth, a cutaneous eruption, which resembled scarlatina more than measles, but was less confluent than either of those affections, and consisted of minute florid red papulæ, slightly elevated, and distributed in irregularly shaped patches, appearing first upon the face and trunk, and spreading to the extremities. On the full development of the eruption, a second febrile exacerbation, with severe arthritic and muscular pains occurred. After two or three days' duration, the eruption gradually disappeared, with some desquamation of the cuticle. In some cases, the lymphatic ganglions of the neck, groins, and axilla remained swelled for a long period.

Of all the symptoms the affection of the joints was most tenacious and troublesome, adhering for weeks to some, and constituting a sort of permanent lameness. A sore mouth was a frequent symptom, and in one or two instances there was pretty severe glossitis.

In regard to the pathology of Dengue, there has been difference of sentiment. Dr. Dickson, (*op. cit.* p. 8,) classes it among the exanthemata; whilst the union of an eruptive fever with an inflammatory affection of the joints gave occasion to its names, *scarlatina rheumatica*, *exanthesis arthrosia*, and *eruptive articular* or *rheumatic fever*.

Causes.—Opinions have varied on this matter. Dr. Dickson is disposed to regard it as contagious. Drs. Osgood and Lehman, who saw it in Cuba, seem disposed to regard it as the ordinary fever of that region, under certain peculiarities of circumstances not well explained; and Dr. Waring, of Savannah, dwells upon its close analogy with the *break-bone fever* of 1826, and the epidemic bilious remittent fever of 1827 in that city. Still closer, according to Dr. Dickson, (*op. cit.* p. 11,) are the points of similarity which may be found in the history of the *break-bone fever* or remittent described by Dr. Rush as prevailing in Philadelphia, in the summer and autumn of 1780, and the epidemic of Calcutta and Berhampore, pourtrayed by Dr. Mellis in 1824–5.

The prognosis was exceedingly favourable. Perhaps no form of disease is known, in which the proportion of deaths was so small compared with the numbers attacked. The aged were most severely handled,—remaining frequently infirm and debilitated, with languor and emaciation. In the intemperate it served to usher in formidable paroxysms of delirium tremens. When it did prove fatal, it appeared to be owing to complications.

Treatment.—The lancet was generally found necessary during the inflammatory period, with cathartics and antiphlogistics. Anodynes were likewise needed to relieve the violence of the pain.

ROBLEY DUNGLISON.]

DENTITION, DISORDERS OF. Under this head we shall endeavour to collect, not all the affections which hereditary errors and popular prejudice have marshalled under it, but such as careful and unbiassed observation has demonstrated to be occasionally induced by the process of cutting the teeth. By adhering to this resolution, a subject, once of interminable length and exaggerated importance, may be brought within comparatively narrow bounds, and if it be curtailed somewhat of its mysterious interest, it will not, we trust, lose in respect of practical utility.

The operations of nature are usually conducted in so skilful and complete a manner as should inspire all reasonable minds with large confidence in her powers, and lead them strongly to doubt all those hypotheses which would make disease a necessary adjunct to the evolution of our corporeal frame. That artificial modes of life, on the other hand, together with injudicious management, an excess of nutriment, with deficient exercise, impure air, and the other causes which tend to derange the general health, must greatly increase the difficulty and danger of the process of dentition, is indubitable; but that the mortality fairly traceable to it should, under any circumstances, have been rated so high as one-tenth and even one-sixth of all the children who undergo it, cannot fail to excite our surprise.

Children, as well as adults, are liable to numerous diseases of the three great cavities; but the difficulty of accurately recognizing them in early infancy too frequently causes their true nature to be overlooked, and disorders which are really idiopathic to be considered merely sympathetic affections depending on the process of teething.

Dentition, though often difficult and painful, is not in itself, properly speaking, a disease; yet the excitement which it produces is favourable to the development of such complaints as there exists a tendency to at this time of life. It is indeed the most critical period of childhood, and the supervention of any serious disease, as small-pox, measles, &c., during its progress, is, from the increased sensibility of the whole system, attended with more than ordinary danger.

The first Dentition. — The rapidity with which the first set of teeth is developed necessarily causes a considerable determination of blood to the head, a circumstance which assists us in explaining many of the morbid tendencies which at this time occur. The rapid evolution which the brain, also, is at this period undergoing, concurs in a still more powerful degree to heighten the nervous susceptibility. This stage of existence is, indeed, remarkably characterized by a tendency to cerebral affections; and diseases of the chest, abdomen, and other parts, often become complicated with them, or towards their termination merge into them. The irritable constitution and extensive sympathies which distinguish infancy, help us to account for the severity of the symptoms which sometimes occur from teething. As the child grows older, though the local affection may be equally violent, the intensity of the constitutional effects is generally much diminished, and accordingly we find that the cutting of the large double teeth occasionally gives rise to much less disturbance than that of the smaller teeth which preceded them.

Any unusual obstacle to the coming forward of the teeth, such as may be caused by a disproportion between their rate of development and that of the jaw; or even their too rapid progress and the consequent appearance of several of them simultaneously, must greatly augment the disturbance produced by this process.

The rudiments of the teeth are visible in the fœtus about the second or third month. As they increase in size, they are found to consist of a double membranous sac, from the bottom of which rises a pulp composed of a vascular and nervous substance, and surrounded by a colourless fluid of a mucilaginous consistence. This fluid is gradually absorbed as the pulp enlarges, and ossific matter becomes visible on the summit of the latter about the end of the third month. The enamel is subsequently formed, but whether by deposition from the fluid, or by secretion from the inner and vascular membrane of the sac, is a disputed point. The jaw at first presents only a channel along its edge; but by the growth of transverse bony septa, this is subdivided into cells, and the alveoli are thus formed. The germs of most of the permanent teeth are visible even in the fœtus, and are situated behind and below the milk teeth.

At the period of birth the ossification of the teeth is already far advanced, the crowns of the incisors being usually completed, and a considerable part of those of the double teeth formed. The ossification of their roots is a subsequent process, and in proportion as it advances, and as the alveoli become developed, the crown of the teeth is propelled towards the surface of the gum, and by the gradual absorption of this, and of the apex of its own enveloping sac, at length makes its appearance externally. The pressure on the membrane and gums, and the consequent irritation which accompanies this stage of the process, give rise to the painful symptoms of dentition.

The milk teeth are twenty in number: they usually appear in pairs, and those of the lower jaw generally precede the corresponding ones of the upper. They succeed each other commonly in the following order: first, the middle incisors; next, the lateral incisors; then either the canine teeth or the anterior molars,—perhaps more frequently the latter,—(but not invariably so, as M. Serres would have us believe;) and lastly the posterior molars.

The first incisor is generally cut about the sixth or seventh month, although occasionally not for many months later; the canine teeth commonly appear about the fifteenth month; and the posterior molars at various periods from the twentieth to the thirtieth. Thus, the whole period occupied by the first dentition may be estimated at from a year and a half to two years.

Such is the usual process of dentition; but it varies considerably in different individuals, both as to its whole duration, and as to the periods and order in which the teeth make their appearance. In scrofulous children, according to Gardien, the first incisors are occasionally cut so early as the third or fourth month; but such teeth are apt to decay and soon drop out. Underwood, on the other hand, has known weakly and rachitic children to be still without a tooth at twenty-two months old; and in such subjects analogy would certainly lead us to expect the ossification of the teeth to be tardy and imperfect. The premature and rapid development of the teeth has occasionally appeared to Guersent to be, not the effect, but the exciting cause of rachitis and tubercles: and, in general, it may be stated that the greater the number of teeth coming forward simultaneously, the greater the danger: those who have them late usually suffer least.

Numerous instances are on record of children who were born with some of their teeth already cut; of which Richard III., Louis XIV., and Mirabeau, were notable examples. In the case of Louis it was brought forward, but fallaciously, as an argument to establish his legitimacy, on which the lateness of his posthumous birth had thrown suspicion. Such premature dentition is neither a proof of protracted pregnancy, nor yet of a strong constitution in the infant, as it has been observed that such children are often unusually small, and most frequently die early. Indubitable instances are mentioned by authors, of individuals who never had any teeth: Borelli knew a woman of sixty years of age in this predicament: certain diseases of the jaw affecting the germs of the teeth may be occasionally the cause of this singular phenomenon. Soëmmering and Fox each saw a case where several of the teeth were consolidated into one mass; and we have met with a similar instance in the Museum at Leipzig, of two incisors grown together by their crowns, whilst the roots are separate.[*] Such abnormal appearances depend, no doubt, on the deficient evolution of the alveolar septa.

The natural symptoms of dentition in its mildest form are an increased flow of saliva, with swelling and heat of the gums, and occasionally flushing of the cheeks. The child frequently thrusts its fingers, or any thing within its grasp, into its mouth. Its thirst seems to be increased, for it takes the breast more frequently, though, from the tender state of the gums, for shorter periods than usual. It is more fretful and restless, and sudden fits of crying and occasional starting from sleep, with a slight tendency to vomiting and diarrhœa, are not uncommon. Many of these symptoms often precede the appearance of the tooth by several weeks, and indicate an increased activity in the process of ossification and development, or what in common language is called breeding the teeth. In such cases the symptoms subside in a few days, to recur again when the tooth approaches the surface of the gum. In the first period the pressure of corals and other hard substances on the gum seems to be agreeable, by numbing the sensibility and dulling the pain. A better form than that of the ordinary coral is an ivory ring, as it obviates the danger of its being thrust into the eyes or nose. Rousseau, in his Emilius, objects to the use of hard substances for this purpose, and refers us to the instinct of the young of other animals, which leads them to exercise their budding teeth, not on bone or stones, but on softer substances, on which they can make some impression. In accordance with this view a stick of marsh-mallows or of liquorice root, a piece of wax-candle or a crust of bread, have been recommended instead of the coral; and in France they often dip them into honey or a sweet decoction of barley, in order to render them more agreeable to the child, and more relaxant to the gums. In some parts of Germany we frequently see infants sucking a small bag containing a mixture of sugar and spices, which is given to them whenever they are fretful or uneasy. It re-acts sufficiently on the gums, and certainly seems a very successful expedient for occupying the child and keeping it quiet: it thus saves the nurse some trouble; but the injury which the constant use of these sweet and stimulant ingredients must do the stomach, renders their employment very objectionable.

Gentle friction of the gums by the finger of the nurse is pleasing to the infant, and seems to have some effect in allaying irritation and altering the mode of the sensibility.

Pain appears to be the chief cause of all the morbid sympathies accompanying dentition, and is attributable partly to pressure on the membranous sac and on the gum, and partly, or, as some think, principally, to the pressure made by the root of the tooth on the dental nerves.

In feeble and delicate children dentition is usually, as we should naturally expect, more tedious and difficult than in the healthy and robust; but to this there are numerous exceptions; and it is certain that when disorder does occur in the latter, they suffer much more severely, and are more apt to be cut off suddenly by superinduced inflammatory affections, as was long ago remarked by Hippocrates. Puny infants, on the contrary, are more prone to a wasting diarrhœa and marasmus; and those reared in a crowded city generally suffer much more than those who have been brought up in the healthy air of the country. In a word, the two extremes of debility and high health, or rather that appearance of it which is induced by over-feeding, are both exposed, and nearly in an equal degree, to danger;—the former from a low wasting fever and bowel complaints; the latter from acute fever, determination of blood to the head, and convulsions. Those who have asserted that robust children always suffer most, have perhaps been mislead by external appearances, forgetting that every the slightest change of condition in the fat and florid child will be more obvious and striking to the eye, than in one which was already pallid and thin.

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[*] In the same museum, which is very rich in preparations illustrating malformation and diseases of the teeth, there are examples of anchylosis of the teeth with the jaw, occurring in rachitic subjects; and others exemplifying the fragility of these organs in individuals of a similar constitution, and explaining their consequent liability to break in extraction.

The management of infants during teething, when the process is going on in a favourable manner, is very simple, and rarely calls for the interference of the physician. The child should be much in the open air, and well exercised, and the bowels kept free. The employment of the cold-bath or cold sponging daily, followed by gentle friction over the surface of the body, is very useful; and all means should be taken to support the tone of the system at a just medium. The breast should be given to it often, but not long at a time, and thus the attendant thirst will be quenched, and the gums kept moist and relaxed, and their irritation soothed, without the stomach being overloaded. The health and diet of the nurse should at this period be particularly attended to, and all stimulant food and drinks avoided.

Dr. John Clarke, in his Commentaries on the Diseases of Children, ascribes most of the disorders which accompany dentition to over-feeding and consequent plethora; to improper kinds of food, which produce irritation; and to keeping the head too warm. He asserts that coolness of the head, and washing it daily with cold water, renders children much less liable to illness during this period. Spontaneous salivation and moderately lax bowels are always to be considered favourable, as they tend materially to diminish irritation; and when absent, their place should be supplied by gentle aperients, especially in the case of plethoric children, or those with cutaneous eruptions.

[It has been a question, whether, during the irritation of teething, when the child is desirous of conveying everything to the mouth, hard substances should be permitted to press upon the gums. It is a common custom to allow the child the use of a piece of coral, or of sealing-wax, or what is preferable—inasmuch as it cannot be forced into the mouth and injure the soft parts of that cavity—an ivory ring. Some of the French writers discard all such substances, but without much propriety. If the gums be very tender, the child will not use them; and, if pressing the gums upon them should afford relief, there appears to be no good reason why their use should be forbidden, as the pressure cannot fail to aid the absorption of the gum. It has been suggested, as a good plan, to allow the child the use of a small wax candle, a stick of liquorice root, or a crust of bread. The first of these may be unobjectionable; but the liquorice root may load the stomach with mucilaginous saccharine matter, if allowed too freely; and the crust of bread may excite alarm, by the softened portions getting into the glottis, and producing symptoms of strangling. The physician, however, is not often consulted on these points; the whole matter being generally regulated by the parent or nurse. (See the writer's *Practice of Medicine*, 2d edit. i. 41.)]

When dentition is difficult and tedious, the treatment is more complicated, and consists in allaying local irritation, moderating urgent symptomatic affections, and when protracted and productive of much exhaustion, in supporting the general strength. But, in order to treat of this part of our subject more satisfactorily, we shall divide the phenomena of difficult dentition into the idiopathic or local, and the sympathetic or secondary. These latter might again be divided either according to their nature, into spasmodic and inflammatory; or according to the organ or texture which they affect; as this latter subdivision appears more conducive to accurate diagnosis, we mean to adopt it.

Of the local symptoms, or those occurring in or near the mouth, painful inflammation and swelling of the gum, which is hotter, of a deeper red than natural, and intolerant of the slightest pressure, are the most usual, and the cause of all the rest. There is often great determination of blood to the head, the cheeks being red, hot, and swollen, the eyes irritable and watery, the salivation profuse, and the salivary glands occasionally enlarged and painful. Aphthæ sometimes occupy the mouth and fauces, and abscesses have, in some rare cases, been observed at the root of the tongue. The symptomatic fever is often great, and is remarkable for its sudden rise and declension, intermitting and recurring frequently in the course of a few hours. The thirst is extreme, and the child is at one time restless and irritable, and at another heavy and oppressed. The sleep is broken, and the infant frequently awakens suddenly and in a fright from its short slumbers. The urinary secretion is usually much diminished, though cases do sometimes occur, as has been mentioned by Whytt, when it is increased, and in such the accompanying symptoms will generally be found to be more of a nervous than an inflammatory character.

As all these symptoms are induced by the painful tension of the gum, the most rational mode of attempting their relief is by freely lancing the swollen part. Of the practical utility and perfect safety of this operation, notwithstanding the prejudices which exist against it in some other countries, we have ample proof in its daily performance with impunity, and in the instant relief which it often affords to all the symptoms. To give it a chance of success it must be done effectually, and both the gum and the capsule of the tooth laid fairly open. An assistant holds the head of the infant firm, whilst the operator, with a gum lancet or a narrow bistoury having three-fourths of its blade guarded, separates the jaws, and keeping the tongue and cheek out of the way with the fingers of his left-hand, cuts down firmly in a longitudinal direction on the inflamed and swollen gum; and if it be a double tooth which is coming forward, he should convert the incision into a crucial one. In Paris they often dissect out the flaps, but this seems to be an unnecessary addition to the pain of the operation. The slight bleeding which occurs is highly beneficial, acting as a local depletion, and thus conspiring to take off tension. The fears of an excessive or debilitating loss of blood from this source, may be considered, as to all practical purposes, unfounded and chimerical. We do not usually recommend the performance of this operation till the tooth be already so far advanced that we can be pretty sure of succeeding in laying open the capsule: for slight scarifications of the gum can afford no effectual or permanent relief. Cases may, however, occur, where even the temporary ease which superficial scarifications are capable of affording should not be renounced; but here we must take care to explain to the child's friends the object of their performance, else the speedy return of the symptoms and the non-appearance of the expected tooth may tend to bring the operation of lancing the gums, or our own skill, into disrepute. The old apprehension that the scars which ensue, oppose, by their hardness, the subsequent progress of the tooth, though repeated in one of the latest French works on the diseases of children, is quite groundless; for cicatrices, like all other new-formed parts, are, as Hunter long since pointed out, much more easily absorbed than the original structure. Slight ulcerations of the gum have in some rare instances succeeded to the incisions; but this is a very unusual occurrence, and may be generally prevented by taking care to have our lancets perfectly clean; they are, besides, of very little consequence, as they readily heal under slightly astringent applications. Both Underwood and Hamilton enumerate ulceration of the gums amongst the occasional effects of teething, and the former thinks they occur even more frequently in cases where lancing has not been performed.

When the pain, determination of blood to the head, and fever, persist after the gums have been freely lanced, laxatives, mild diaphoretics, the warm bath, and slightly stimulating pediluvia must be employed, and if these be insufficient, one or two leeches should be applied behind the ears. When by the above means the fever has been in some degree reduced, the bowels continuing free, if the pain be still very severe, the cautious use of anodynes, as a drop or two of tincture of opium, or minute doses of hyoscyamus, may be tried. But perhaps as a general rule, seeing that infants are so very susceptible of the influence of narcotics, their external use, in the form of anodyne frictions to the spine, is preferable. When very restless at night, the infant should be frequently taken up and carried about in an airy room: by the cool air and the nearly erect posture, the feverishness will be alleviated, and the tendency of blood to the head counteracted.

Such are the measures which modern experience has found the most effectual in moderating the pains of dentition. Very different was the practice of our forefathers, who, misled probably by the fanciful doctrine of signatures, were in the habit of applying to the gums specific ointments made of the brains of hares, or of the combs of cocks, which, as old Hartman would have us believe, "cause the production of teeth without difficulty and free from accidents." Whilst we smile at the credulity of former generations, we must not forget that the anodyne necklaces and other charms still in use in our own day are in no wise more trustworthy or less absurd.

With regard to the affections of distant organs occurring during teething, we must not forget that they may originate as primary or idiopathic diseases at this period as well as at any other. Still, after making every allowance on this score, certain disorders manifest themselves so much more frequently during this process, and often subside so rapidly on the appearance of a tooth, as to leave us no doubt with regard to their occasional connection with the business of dentition.

Of the disorders which may be thus called into action by the irritation of teething, very formidable lists have been made out by authors. The following is a specimen of these, and of the confused manner in which symptoms and diseases are often jumbled together: vomiting, anorexia, diarrhœa, cholera, costiveness, increased or diminished urine, urethral or vaginal discharge, with painful micturition; dry cough, dyspnœa, catarrh, pneumonia, spasmodic affections of the face, limbs, glottis, &c.; insomnia, agitation and fright on awaking, epilepsy, somnolence, stertor, coma, transient palsy of the arms and legs; ophthalmia, hydrocephalus, marasmus; eruptions, especially about the head and face, swellings of the hands and feet, enlargement of the cervical, femoral, and mesenteric glands, and other scrofulous affections.

From this enumeration it appears that the chylopoietic and respiratory organs, the brain and nervous system, the skin and the lymphatics, are the chief seats of the sympathetic affections occasionally induced by dentition.

Of these secondary affections, those of the mucous membranes are the most frequent, and they may be either inflammatory or not. Inflammation of the conjunctiva, of the mucous membrane of the air-passages and lungs, or of the stomach and intestines, will be characterized by the usual symptoms, and require the same kind of treatment as idiopathic inflammation of the same parts, though it will rarely be necessary to push it so far. Incision of the inflamed gums should always be premised, and will sometimes, without the employment of almost any other measures, be followed by the speedy resolution of the disease.

Far the greater number, however, of these affections are not truly inflammatory, but depend on a peculiar state of irritation kept up in these remote organs by sympathy with the inflamed gum. Such, usually, is the nature of the accompanying cough, vomiting, or diarrhœa. When the vomiting and purging are not attended with pain on pressure, redness of the tongue, loss of appetite, or great oppression and fever, we have no reason to believe in the existence of inflammation, either in the stomach or intestines. Such symptomatic vomiting may usually be restrained by diminishing the quantity or varying the quality of the child's milk or other food; and if there be evidence of excessive determination of blood to the head, by the application of one or two leeches behind the ears. Should it prove very obstinate, and debility, and loathing of food be induced by it, narcotic frictions and fomentations of the abdomen, and a small blister applied for three or four hours to the epigastrium or to the upper part of the spine, may be requisite.

In severe and protracted diarrhœa interfering with the sleep and nutrition, and accompanied by debility, emaciation, pallid skin, a dull eye, and sunken expression of countenance, in addition to some of the above measures, tonic and alterative aperients are called for, such as rhubarb combined with ipecacuanha or hydrargyrum cum cretâ. Absorbents will be necessary if there be acidity in the primæ viæ, which is a frequent symptom in the derangement of the digestive organs induced by teething, and is evidenced by griping and by green and sour-smelling stools. If the discharges are of a bad quality, being fetid, blackish, or very pale, an occasional dose of calomel to modify the intestinal secretion should be exhibited. In very obstinate cases the cautious use of Dover's powder, opiates alone, or in combination with minute doses of calomel, and given at short intervals, or opiate enemata may be indispensable. But in the latter mode of exhibiting opium, especially in the case of children, we must never forget that its action is sometimes, as has been pointed out by Dupuytren, even more energetic than when given by the mouth. The diet must be particularly attended to, the nurse changed if her milk seem to disagree, and the strength supported by beef-tea, rice-milk, arrow-root, &c. In many of these cases, quinine in small doses will be found a very useful auxiliary. We are not advocates for the premature use of medicine in this affection: as on the one hand neglected diarrhœa is a frequent cause of death in dentition, and as on the other a lax state of the bowels has a great influence in moderating the dangers of this period, it requires a very nice discrimination on the part of the practitioner to know when to interfere. Perhaps no attempt should be made to check the intestinal secretion so long as the appetite, sleep, and strength continue unaffected. It is certain that bowel complaints, which would be thought very alarming at any other time, are often well borne when they depend merely on the irritation of teething. We should therefore, in most cases, content ourselves with watching their progress as long as they keep within the limits stated above.

Vomiting and purging often co-exist, and in their combination frequently constitute a very formidable affection. M. Cruveilhier has described, under the title *Maladie gastro-intestinale des enfans avec desorganization gelatiniforme*, a very violent and fatal disease of the stomach and intestines of this kind, which is characterized by excessive thirst, urgent vomiting, and frequent, very fetid, green stools, like chopped spinach. After repeated vomiting the child becomes cold, and falls occasionally into a state approaching to syncope. The pulse is slow and irregular; the intellectual faculties continue clear to the end. The infant is extremely irritable and cries incessantly, except whilst being carried about in the nurse's arms. A state of drowsiness and oppression soon supervenes, the face assumes a cadaverous appearance, and the eyes are half closed and turned up. The coldness of the body, and especially of the extremities, goes on rapidly increasing, and in the course of twenty-four or forty-eight hours, a state of extreme prostration and fatal collapse are sometimes induced. By a superficial observer this disease might be mistaken for a cerebral affection, as there is somnolence and screaming, with slowness and inequality of pulse in both; but in the peculiar disorder under consideration the somnolence is interrupted by the slightest touch, the sensibility of the skin is morbidly increased, the intellectual faculties are entire to the last moment, and the respiration is not unequal, as in disease of the brain. On dissection, the mucous membrane of the stomach, and generally that of the small and great intestines, is found in a state of softening, being reduced to a soft and disorganized pulp, but without any appearance indicative of inflammation. Cruveilhier's treatment consisted in confining the diet entirely to milk, and giving even that in the very smallest quantities, together with baths and fractional doses of opium administered at short intervals, both by the mouth and in enemata. The chief causes of the disease seem to be improper food, premature weaning, and dentition. It may run on for many days, or even weeks, and when it proves fatal, terminates at last either by an acute attack or by gradual sinking. It is evidently closely allied to cholera morbus, and is in no degree an inflammatory affection.

M. Guersent, physician to the Children's Hospital at Paris, has given a description of the above disease, differing in some respects from that of Cruveilhier's. He remarks that this peculiar combination of vomiting and purging occurs only in young infants from three or four months old to the end of the period of dentition, and is most common when they are getting the canine and double teeth. The diarrhœa is extremely abundant, and the stools are sometimes yellow, but oftener green, like flocculi of confervæ floating in a transparent serous fluid. Vomiting is soon superadded, first of a serous fluid, and at a later period of a porraceous matter. A dry cough and irregular febrile exacerbations usually occur in this affection: the prostration of strength and emaciation are extreme. Towards the close, slight convulsive motions are observed, chiefly about the face and eyes. The voice becomes excessively feeble, the features become relaxed, and the child sinks at length either in a state of agitation or of extreme exhaustion, whilst the consciousness to surrounding objects continues unimpaired to the last. There are some varieties of the disease: thus the diarrhœa may precede the vomiting many days; or they may both commence nearly at the same moment, and the child then dies with symptoms of cholera in the space of three or four days, or occasionally even within twenty-four hours. The affection sometimes, however, assumes a more chronic form, lasting thirty or forty days; but here there are frequent suspensions and renewals of the symptoms. On dissection, the mucous membrane of the stomach and intestines has usually been found pale, colourless, and almost transparent, as if it had been macerated in water, and the mucous follicles are in their natural state. In some rare cases slight redness has been evident in the cœcum and colon, but this so seldom, that it could only be considered as a casual complication; and the same may, according to Guersent, who is here at variance with Cruveilhier, be said of the softening of the mucous membrane of the stomach and intestines, which forms no essential or constant part of the disease. The treatment which he has found to succeed best in this peculiar affection, as well as its morbid anatomy, tends to prove that it is much more nearly allied to cholera than to gastro-enteritis: this treatment consisted in the very lowest diet, mucilaginous drinks, emollient injections, fomentations and narcotic cataplasms. Leeches are almost always useless or injurious. As the disease advances, baths and the very cautious use of opiate enemata are proper; and when the prostration is extreme, sinapisms and blisters should be applied to the limbs, nucha, or abdomen. Tonics and stimulants have usually seemed to do harm. In the acute or cholera form it mostly proves fatal in spite of all kinds of treatment. It is here from opiates internally that we can alone expect any benefit.

Dr. Parrish, of Philadelphia, has described a spasmodic affection of the intestines, or a species of flatulent colic, which he thinks is often dependent on the irritation of teething. The belly swells up rapidly and becomes extremely tender to the touch, the child cries much, the muscles of the face and limbs are spasmodically contracted, and the stools are suspended. The only thing which gives relief is the expulsion of flatus, and the consequent reduction of the tympanitic state. The appropriate remedies, after lancing the gums, seem to be draughts or enemata, containing a few grains of assafœtida, and two or three drops of laudanum, friction of the abdomen and spine with an anodyne liniment, and the induction of a free state of the bowels by some gentle aperient, or a soap suppository. Mr. Parrish has recommended, as an immediate mode of relief, the extraction of the air from the rectum by means of a syringe.

Having already alluded to disorders of the chest, we shall here only add that a susceptibility to catarrhal, and even peripneumonic affections, seems to be occasionally induced by teething. When the presence of inflammation is indicated by fits of coughing so painful as to make the child cry, and by soreness of the chest, dyspnœa, anorexia, and feverishness, after lancing the gums, repeated purgatives, emetics, and diaphoretics will often afford much relief; but in severe cases leeches and blisters must never be omitted.

The dry nervous cough of irritation is, however, by far the most frequent species, and may occasionally be much alleviated by anodyne frictions of the spine and abdomen, though it often resists all treatment till after the tooth is cut, and then ceases spontaneously. Cough at this period seems sometimes to depend on an intermediate derangement of the digestive organs, as is indicated by the state of the tongue, tension of the abdomen, unnatural stools, and the absence of fever: here emetics and purgatives are the appropriate remedies.

Affections of the brain and nervous system may occur in every degree from a slight and passing determination of blood to those organs, up to the most violent irritation, congestion, or even inflammation. The pain in the gums keeps the nervous system in a state of constant excitement, which is favourable to the development of spasmodic affections.

When there exists considerable plethora and drowsiness, the use of purgatives and leeches, with blisters to the nape of the neck, is indispensable. On the other hand, a state of insomnia is occasionally induced; or the sleep is much interrupted, and the infant often awakes with a start, frightened and crying. This should never be overlooked by the physician, as it indicates a condition in which the occurrence of epilepsy or convulsions is by no means improbable. It seems sometimes to depend on cerebral congestion, and sometimes on derangement of the digestive organs, though occasionally it is purely nervous; and according to whichever of these may be its cause, it will require the use either of leeches and purgatives, or of antispasmodics and warm baths.

Where much fever accompanies dentition, convulsions often occur, especially if the bowels be in a constipated state. Neither feeble and irritable, nor large and fine infants are exempt from their attacks: but the latter are the most apt to be cut off suddenly by them. It is with the protrusion of the anterior molars, or of the canine teeth, that they most frequently come on; and they are occasionally preceded by grinding of the teeth, trembling of the lips, and other premonitory symptoms. They are not always so dangerous as is commonly imagined, and are least so when confined to spasmodic motions of the eyes, face, and arms. But if, on the other hand, the fits are very general and violent, and succeed each other rapidly, they are then always very alarming. They occasionally terminate in apoplexy or paralysis. As very formidable convulsions have been known to cease immediately on the gums being lanced, this operation should never be neglected where they appear swollen and painful. Tepid baths, leeches, purgatives, narcotics, and antispasmodics, are severally useful in different states of the system. Thus, if pain be the predominant symptom, we should avail ourselves of the soothing influence of tepid baths; if the sleep be lost, the cautious use of narcotics will be justifiable, provided there be no fever; otherwise, and especially if the child be plethoric, purgatives and leeches must be premised. In weakly children, assafœtida and some other medicines of the antispasmodic class have been occasionally found useful. Sprinkling cold water in the child's face while in the bath will often cut short the fit; and when the recurrence of the disease is very frequent, an issue at the back of the neck, or the production of an artificial eruption, is to be recommended. (See Convulsions, Infantile.) Underwood speaks of a transient palsy of the arms and legs occurring as each tooth is coming out, and which does not require any particular treatment beyond attention to the gums and to the bowels. The paralysis after convulsions is often permanent and hopeless: leeches and counter-irritation to the spine should, however, have a trial in such cases.

Of the convulsive affections occurring during dentition, one of the most formidable is *spasm of the glottis*, sometimes, but improperly, termed spasmodic or chronic croup. Dr. John Clarke has described it under the title of "*a peculiar Convulsion of Infant Children;*" and it has also been noticed by Dr. Hamilton, of Edinburgh, and Dr. Cheyne, of Dublin. Dr. Monro has alluded to it where he speaks of a peculiar species of hydrocephalus, attended with spasm of the glottis. It has been written on by Mr. Pretty, in the Medical and Physical Journal, under the name of *cerebral croup*, and has been described, in France, by M. Guersent, under the title *Pseudo-croup nerveux*, and still better by Gardien, under that of *Spasme du thorax et de la glotte;* and by Richter, Raimann, Schmalz, Wichmann, &c. in Germany. But the latest, and much the most satisfactory account of this disease is that by Dr. Marsh, in his paper in the Dublin Hospital Re-parts, vol. v. to which, and also to the article GLOTTIS, SPASM OF, in the present work, the reader is referred.

A peculiar swelling of the hands and feet has been mentioned by Underwood as an occasional symptom of painful dentition. It was considered by him as in itself, if not decidedly beneficial, like a slight diarrhœa, at least unimportant, as he found it to cease spontaneously when the tooth came up. If any feverishness co-existed, he attributed it not so much to those tumours, as to the casual coincidence of derangement in the bowels or some other organ.

Dr. Kellie, of Leith, who has described this singular affection more at large, asserts that though it be sometimes thus slight and transient, yet in many cases it has appeared to constitute a part of a disease of a more striking and serious nature. The swelling, which is situated on the back of the hand and on the dorsum of the foot, has a considerable degree of roundness and elevation, such as might be produced by a blow. It seems to arise suddenly, and is of a mottled, somewhat livid, or purplish colour, feeling rather cold, and exhibiting no sign of inflammation or increased sensibility. It is firm, and does not pit on pressure. It will occasionally continue for weeks, gradually becoming softer or assuming somewhat of a leucophlegmatic hue, to which occasionally, but very rarely, œdema of the whole limb has been known to supervene. Usually, however, it disappears more suddenly, without passing into the leucophlegmatic stage. It is generally connected with a symptom of a more formidable character than itself, viz., the spastic contraction of the flexors of the thumb and toes. The thumb is rigidly contracted and permanently bent downwards, and laid flat upon the palm of the hand; and in like manner the toes are bent down to the plantar aspect of the foot. The carpus is also sometimes drawn down by its flexors, so as to increase the sphericity of the metacarpal bones. The child is peevish and restless, but does not seem to suffer much pain in the affected parts. In some cases only there is pyrexia towards the evening; the bowels are commonly torpid, and the stools procured by laxatives are fetid, clayey, green, sour, and slimy. Its duration is from a few days to several weeks, and its termination usually favourable. General convulsions have, however, sometimes supervened; in one of Dr. Kellie's cases fever made its appearance, and two others died with what Dr. Armstrong calls symptoms of "hectic teething." It is a disease of the epoch of dentition, and as the symptoms have occasionally ceased immediately after the cutting of a tooth, we may conclude that teething is, at times at least, its exciting cause. The treatment recommended by Dr. Kellie consists in scarifying the gums, removing plethora if it exist, restraining vascular excitement and local determination, and regulating the alvine discharges.

Of the cutaneous eruptions connected with dentition little need be said, as they seem, by their derivative action, like a lax state of the bowels, to be rather useful than otherwise. The principal varieties are, an erythematous efflorescence behind the ears (intertrigo); crusta lactea; the different varieties of strophulus (the red gum or tooth-rash of the vulgar); small phlyctenæ, like those of a burn, and evanescent red spots appearing upon the face and other parts. But as most of these may occur also quite independently of dentition, we can be certain of the connexion in those cases only when they make their appearance, or undergo an exacerbation, just before the cutting of a tooth, and become milder or disappear after it. Should they run to such an extent as to become troublesome, laxatives are the best means of keeping them down. During their existence exposure to cold should always be avoided.

Disease of the lymphatic system is an occasional result of the debility often induced by teething, and is manifested in the enlargement of the cervical, inguinal, and mesenteric glands, &c. In these, as in all other scrofulous affections, our chief attention should be turned towards the improvement of the general health by good air, nutritive food, regular exercise, attention to the digestive organs, and other measures to which we have alluded in a preceding paragraph.

The Second Dentition.—The milk-teeth generally begin to fall out about the seventh year, or somewhat earlier, and are replaced in the course of five or six years by the permanent teeth, which usually come up with little or no pain. Cases do, however, occasionally occur in which there is considerable local irritation, and consequent enlargement of the glands about the jaw and neck, ophthalmia, cutaneous eruptions, &c. The wisdom-teeth, which are cut about the twenty-seventh year, or occasionally much later, are often productive of considerable uneasiness and swelling. The pain being sometimes periodically intermittent, has been mistaken for an aguish or rheumatic affection, and treated with bark and similar medicines. Cases are mentioned where, from the imperfect development of the jaw, there has not been room enough for the dentes sapientiæ to come easily forward; and hence much pain and swelling of the face, together with violent headach, inflammation of the eyes, pain in the ear, and abscess near the angle of the jaw, have resulted. Free incision of the gum, or even extraction of a tooth, may, in some of these cases, be necessary, along with leeches, fomentations, and poultices to the external swelling.

The second set of teeth occasionally come up before the first have fallen out, and we have then the singular appearance of a double row of teeth: on the other hand, there are instances on record of individuals who did not begin to get the second set till they were forty or fifty years of age. The cases in which very old persons have cut a third set of teeth (See Ed. Med. Comment. vol. iii.) are so extremely rare, that we only allude to them because their development has been sometimes accompanied with excruciating pain and other circumstances, which might be extremely puzzling to the practitioner if not aware of the possibility of such an occurrence.

W. B. Joy.

DERIVATION (from *derivare*). This term may be received in two acceptations: it may apply to an effect produced on any morbid condition of parts by an artificial irritation or determination elsewhere, which removes or diminishes the primary one; or to the removal or diminution of a morbid condition, consequent on the occurrence of a new irritation or excitation of action *not* artificially produced. Thus when a blister is applied in a case of pneumonia, with relief of the pulmonary disease, we have an example of the first acceptation; and when a disease of the lungs subsides on the occurrence of a cutaneous eruption, or of a diarrhœa, we have an instance of the second. In either case the principal pathological phenomenon is the change of the seat of irritation or excitement.

The term *revulsion* is one better adapted to express this phenomenon, but it matters little which phrase we adopt. The older authors entered into many arguments respecting the difference between revulsion and derivation, but as their ideas on these subjects were founded on false physiological views, we shall pass them by here.

The circumstances under which derivation, as taken in its first acceptation, is observed, may be thus enumerated.

First, the application of agents to the two great surfaces of relation, namely, the skin and mucous membranes, calculated to irritate or merely increase the normal action of these tissues; and secondly, the use of stimulants calculated to excite the secretions of various of the parenchymatous organs. Under these heads may be enumerated all the irritating applications which we make to the skin, such as cantharides, ammonia, tartar emetic, &c., and also the use of friction and heat. When we employ purgatives to cure a dropsy, or a disease of the skin or of parenchymatous organs, when we use diaphoretics to relieve a mucous inflammation, or diuretics to remove serous effusions, we act on the derivative or revulsive system, and the remedies are in all cases derivatives or revulsives. In some of these cases, we cure or alleviate the original disease by the production of a new inflammation in the part acted on, as in the case of blistering; in others, the part acted on is not made the seat of a new inflammation, but its normal secretion is excited and increased, as in the case of warm bathing producing diaphoresis.

The second example of artificial derivation is the production of irritation in tissues deeper seated than the skin, but still exterior to the viscera. Of this, the use of setons and issues is an example.

But, as we have already shown, derivation or revulsion is often found to occur independently of any artificial excitation, and the consideration of this subject comes to be of the highest interest in medicine. As, however, it is more immediately connected with metastasis, we shall in this place merely sketch the leading physiological facts connected with this species of derivation. One of the most interesting of these is, that this revulsion often occurs between analogous tissues; thus, in cases of inflammation of the synovial membranes, the sudden subsidence of the disease is commonly followed by inflammation of some of the serous membranes, such as the pericardium, peritoneum, pleura, or arachnoid. Again, a patient has diarrhœa; this suddenly subsides and is succeeded by violent bronchitis; he has a disease of the skin, which is repressed, and the mucous membranes become engaged, or *vice versa*. But this rule is by no means so general as to form a law in pathology, for we find very many instances of exception; for example, the occurrence of ascites after suppression of the perspiration, hemorrhage from the kidneys after the desquamation of measles; the alternation of catarrh and hemiplegia; of gout and gastro-enteritis, or bronchitis; of mania and œdema of the lower extremities.

We shall not here examine the relation of cause and effect in these examples of conversion of disease; it may suffice to remark, that in some cases the subsequent or secondary disease appears to arise from the cause so well illustrated by Broussais, namely, the predominance of the sympathetic over the primary irritation; while in others it seems to result from a morbid condition of the whole system, consequent on the subsidence or removal of some local irritation, which, from its chronic duration, has apparently become necessary for the proper balance of the constitution.

Two modes of revulsion are used in medicine. In the first, we endeavour to change the seat of irritation or excitement from the viscera to the surface; in the second, we change it from one viscus to another. The first may be called the exterior or peripheral revulsion; the second, the interior or visceral. To the first of these we shall in this article principally direct our attention.

The modus operandi and therapeutic application of the exterior derivatives are questions of great interest in medicine. In some cases the application of a blister to the surface is followed by great relief of the internal disease, while in others the reverse occurs. To determine the cases in which the favourable or unfavourable results may be reasonably expected, comes to be a great desideratum. Here experience is our chief guide. It has been long known that blisters will relieve local inflammation of the internal parts under three circumstances; *first*, where the disease is of the acute character, but modified in its intensity by active antiphlogistic measures; *secondly*, where it is acute, as respects the time, but occurring in cases where the powers of life are low, as in typhoid inflammations; and, *lastly*, in chronic diseases. In all these cases, the activity of the capillary circulation in the diseased part is weak, and revulsion taking place with ease, a rapid removal of the local disease is often the effect of our treatment. On the injurious effects of external revulsives in acute inflammations, before depletion is used, most authors are agreed. Rostan, in his Clinical Medicine, says, "Revulsions are generally contra-indicated in the early stage of acute diseases when there is fever and the subject is young and strong." The same author. in another place, says that although a derivative effect is often obtained, yet that in many cases excitation will follow the use of revulsives, and an effect directly contrary to that expected will be produced. Mr. Porter, in his "Surgical Observations on the Diseases of the Larynx and Trachea," expresses himself strongly against the use of blisters in acute laryngitis, particularly when applied to the neighbourhood of the part. He says, they cannot be resorted to at an early period without considerable risk of doing mischief. A case is related, where, in acute pneumonia, the application of a blister was followed by an aggravation of the symptoms and death. On dissection, a portion of the surface of the lung, exactly corresponding to the size and shape of the blister, was found in a more advanced stage of inflammation than the remaining pulmonary tissue. Many other authors might be quoted to the same effect. Our own experience is decidedly in favour of these views. We have often seen a distinct exacerbation follow the application of a blister in the acute pneumonia, bronchitis, or gastro-enteritis of children, in cases where bloodletting was not used; and many medical friends have informed us of similar occurrences in their own practice. Even in a few chronic cases we have observed the same effect where local bleeding has not been premised.

We must, then, admit that external derivatives have two modes of action; the one derivative, the other directly stimulant on the diseased part. We find them, as we stated before, generally useful in three sets of cases, namely, acute inflammations where general and local bloodletting has been premised, typhoid inflammations, and chronic diseases: and it becomes probable that a *part* at least of their utility is owing to the direct stimulus conveyed to the capillaries of the diseased tissue. A state of these vessels, analogous to Andral's *asthenic hyperæmia*, in all probability exists, and we know that stimulation is often the best mode of removing this morbid condition. This will account for the injurious effects of external revulsives in acute cases before depletion has been used, and is not inconsistent with their good effects in cases of a different description. They are all essentially stimulants. If the irritability of the system is great, an increase of fever will be the result of the sympathetic irritation of a blister, and in this way the local inflammation will be aggravated. Whether the increase of the local disease be always owing to this cause, or whether it may occur without the intervention of sympathetic fever, are questions of difficulty, but happily not of great practical importance.

We often find, in cases of intense irritation of internal organs, that blisters will not vesicate the skin, but that, as soon as the disease has been modified, they will produce their usual effect. Can this be explained by supposing, that in consequence of the intense inward determination, the surface has lost a portion of its vitality? In such cases, the vesication of the surface is often not the cause, but the consequence of the diminution of diseased action.

The means generally employed to produce external revulsions are the application of blisters, sinapisms, or the tartar emetic ointment; and the use of setons, issues, the moxa, heat, and friction. In this country the most common mode is the application of blisters, either immediately over the diseased organ, or at some distance from it. Unpleasant consequences often follow even this simple proceeding; of which the principal are the infliction of great pain, the production of a too violent inflammation, and the occurrence of strangury. All these bad effects appear frequently to arise from the practice which commonly prevails of allowing the blister to remain on for twelve or even twenty-four hours; a mode of proceeding totally useless, and constantly injurious.

Dr. Leahy, the learned Professor of the Practice of Medicine in the School of Physic in Ireland, has long inveighed against this practice. His mode is to remove the blister as soon as decided pain is produced, although the part be not vesicated. Simple dressings are then applied; and free vesication subsequently occurs; and in the majority of cases none of the distressing effects alluded to are produced. We can speak from our own experience of the superior efficacy of this mode, and feel strongly disposed to believe that were it more constantly pursued, we would see fewer cases of the aggravation of internal disease from the use of blisters.

These views are also much insisted on by M. Bretonneau, in his Traité de la Diphtherite. His mode of using blisters is peculiarly elegant, being founded on the experiments of Robiquet, which show that the vesicating principle is soluble in fatty substances. A piece of extremely thin paper is inserted between the blister and skin, through which of course the oily solution penetrates. Many of the inconveniences of the common mode of blistering are avoided, such as the long-continued irritation that portions of the cantharides produce by sticking to the part; the unsightly marks which blisters leave, &c.: and M. Bretonneau states that during six years' practice in his hospital, there did not occur a single case of ischuria after blistering performed in this way.

Some practitioners, particularly on the Continent, prefer applying blisters always at some distance from the seat of disease; in this way, according to their opinion, avoiding the danger of direct stimulation. Facts are still wanting to enable us finally to determine on the relative merits of these two modes of proceeding; but if the use of a blister over a part affected with acute inflammation is avoided until its capillary irritation has been modified by antiphlogistic treatment, we believe that the practice will generally be found safe.

The use of the tartar emetic ointment, as recommended by Jenner, has now become very common. In some cases, however, it is productive of great distress, in consequence of the formation of large and angry pustules; a circumstance in most cases arising from the use of too great a quantity of the salt in forming the ointment. A drachm to the ounce of lard is the usual proportion; but if we employ a diminished quantity, the remedy will act much better, and frequently with little or no distress to the patient. From a scruple to half a drachm of the salt, finely pulverised, is generally sufficient; and in this way an extensive eruption of minute pustules will be produced, from which we have never seen any unpleasant consequences to follow. An extraordinary effect of this mode of counter-irritation has been several times observed, namely, the supervention of violent irritation about the parts of generation. At first it was supposed that the irritating substance was directly conveyed to the parts by means of the patient's hands; but this opinion is untenable, as the eruption has occurred in cases where the greatest caution was used to prevent any direct conveyance of the ointment to the genitals. This circumstance is noted by Dr. Mackintosh, in his Practice of Physic; and both

Dr. Graves and the writer of this article have had frequent opportunities of observing it in the Meath Hospital. In a case which occurred in private practice, the inflammation about the genitals in a young female was so severe as to threaten mortification. Another unpleasant result of this mode of counter-irritation is the occurrence of violent and obstinate vomiting, particularly where the ointment has been rubbed over the epigastric region.

We shall now proceed to consider the use of external revulsion in cases of visceral disease. Authors appear to agree as to the impropriety of using revulsives in cases of disease of the brain when it is acute, and particularly where bloodletting has not been premised; thus fully bearing out the doctrine which we have endeavoured to support in this article.

In diseases of the brain and spinal marrow, all the different modes of revulsion have been practised with great success. Indeed, with the exception of the first stage of acute irritations, it may be said that revulsives are of the highest utility in all cerebral diseases, whether functional or organic: where coma supervenes, and in chronic affections, the best results often follow this practice. Thus in all the forms of paralysis depending on disease of the brain and spinal marrow, the various revulsives have long been recognized as among our best remedies; and they may be often employed as prophylactics, as in cases where an apoplectic disposition decidedly exists, and where the life of the patient may be prolonged by the timely use of a seton in the neck.

Dr. Jenner, in his letter on the influence of artificial eruptions, speaks in the highest terms of the utility of the tartar emetic ointment in the cure of insanity, declaring that in all his cases (eighteen in number) this treatment succeeded in removing the disease. Dr. Burrows, however, is by no means so sanguine; but states that in cases where insanity has ensued on the subsidence of a cutaneous eruption, or is connected with gastric irritation, this treatment will ameliorate the symptoms. He prefers the use of the tartar emetic ointment to that of blisters.

In Lallemand's "Lettres sur l'Encéphale," a case is recorded highly illustrative of the effects of powerful revulsion under the most unfavourable circumstance. A patient, upwards of sixty years of age, became affected with symptoms of encephalitis, in consequence of an injury of the head. The prominent symptoms were stupor, paralysis with convulsions of the right arm, embarrassment of speech, and loss of memory. The circumstance of the injury of the head being unknown to his medical attendants, the case was considered as an example of idiopathic fever, until the tenth day, when the patient was seen by M. Lallemand for the first time. The patient had then frequent and long-continued fainting fits; the limbs on the right side were contracted, with complete paralysis of sensation; the eyelids closed, the eyes divergent and insensible to light; there was complete loss of hearing and intelligence; the body was covered with a cold sweat; the respiration frequent and stertorous; and the pulse imperceptible. In this desperate state, Lallemand applied boiling water to the legs of the patient. The first application produced a sudden motion of the whole body; the left arm was agitated, the eyelids were raised, and the pulse became perceptible in the arm. In the course of half an hour the boiling water was applied to the thighs with still more remarkable effects: the face became red, and the pulse full and frequent. Ice was now applied to the head, and in two hours the sensibility was so so much restored that the patient frequently attempted to remove the cold application. Under this treatment, with the occasional application of a few leeches to the head, the patient was nearly restored in the course of eight days; and in two months all paralysis had disappeared. The eschars produced by the boiling water were very deep, and suppurated abundantly, seven weeks elapsing before cicatrization took place. Dr. Mackintosh, in his Practice of Physic, details a case of severe cerebral affection in fever, where the best results followed a similar practice. In this case, however, neither paralysis nor coma had taken place.

In the employment of revulsives in diseases of the brain, it appears most proper to select for the place of stimulation some part remote from the cranium. In this way the action of the revulsive can be powerfully assisted by the application of cold to the head, as by the use of ice, or, what is still better, the cold affusion, used in the manner directed by Dr. Abercrombie.

We may here notice the *practice of counter-irritation along the spinal column, as proposed by* Mr. Teale for the cure of *hysteric affections; and* which, according to him, has been followed by the best effects. It would appear, however, that as yet a sufficient number of observations has not been made to establish the pathological views on which this practice is founded. Doubtless, cases of spinal irritation do occur where the use of revulsion may be followed by the best results. In veterinary practice we have known good effects obtained, in cases of tetanus, by the use of severe counter-irritation along the spinal column.

In diseases of the respiratory organs, whether of the mucous membrane, parenchyma, or serous investment, revulsions have long been employed by physicians. The same principles which guide us in the use of revulsives in diseases of the brain are found to apply here:—improper in the acute stage, and even dangerous when the irritation has not been reduced by antiphlogistic measures, they are found generally of the highest utility in cases where the lancet has been used, and where the inflammation is of an asthenic or chronic character. In simple acute laryngitis, the best authors agree as to the impropriety of using blisters to the anterior portion of the neck. Guersent and Porter express themselves most strongly on this subject; the former, however, admitting that they may be useful in the *asthenic croup;* but he prefers employing them at a distance from the affected part. Indeed, there are few diseases where so much caution should be used in any mode of treatment which would have a chance of increasing irritation; as we know that a momentary spasm of the glottis may suddenly extinguish life. In an irritable patient, then, we must be extremely cautious in the employment of the revulsive mode. But in chronic laryngitis we find the best effects from counter-irritation in the neighbourhood of the part;

repeated blistering, frictions with the tartar emetic ointment, and the use of the seton, being among our most successful modes of treatment in this obstinate disease.

The good effects of severe counter-irritation in a case of chronic laryngitis of long standing, and which threatened the life of the patient, were strikingly exemplified some time ago in the Meath Hospital. The symptoms were extremely urgent, and were not alleviated by local bleeding. Two blisters, of about two inches wide and five in length, were applied along the course of the sterno-mastoid muscles, and the vesicated surface sprinkled with finely powdered tartar emetic. A most severe counter-irritation was thus produced; the patient suffered extremely; but the laryngitis was completely removed, and we believe the cure was permanent.

In diseases of the lungs we find the same general principles equally to apply. We have seen many instances where the symptoms of acute pneumonia or pleuritis were clearly aggravated by the empirical use of blisters; but in the second state of acute bronchitis, in most of the forms of chronic catarrh, in hooping-cough, in hepatizations, or passive congestions of the lung, and in the advanced stages of pleurisy, the revulsive practice is almost always followed by the best effects. The utility of the same practice in cases of chronic phthisis is so well known that we need not comment on it here.

One of the most distressing circumstances in the progress of a case of hypertrophy of the heart, is the occasional increase of palpitations and præcordial distress: this is frequently relieved by the application of a blister; a circumstance which, combined with our knowledge of the efficacy of local bleeding in similar cases, adds greatly to the probable correctness of Andral's opinion, that in many such cases the cause of these symptoms is an irritation of the internal membrane of the heart.

In the examination of the effect of external revulsion in diseases of the digestive system, we must consider its employment in affections of the mucous and serous membranes. Broussais, in his Phlegmasies Chroniques, endeavours to establish that in inflammations of the mucous membrane, both acute and chronic, such practice is always improper, and that those cases of altered function which are relieved by vesication of the surface, are not in reality examples of inflammation of the mucous membrane. This assertion, however, appears too general; both analogy and experience lead to the conclusion that in acute gastro-enteritis the use of revulsives to the surface will be probably followed by bad consequences, but this is far from applying to the chronic affections, where we know that this practice is constantly productive of the best effects. In schirrhus of the stomach, in chronic diarrhœa, or dysentery, in tabes mesenterica, the great utility of external revulsives has long been established; so that, as far as the affections of the gastro-intestinal mucous membrane are concerned, the general principle which we have been endeavouring to establish is also borne out. In point of fact, Broussais does not seem to be sufficiently aware of the utility of stimulation in the internal as well as the external chronic inflammations.

The same conclusions are to be drawn in the case of peritonitis. In the violent acute disease, and particularly before general and local bleeding has been freely premised, a blister often aggravates the symptoms; but in the chronic and asthenic forms of the disease, as in the low puerperal peritonitis described by Dr. Cusack and Dr. Gooch, it is found that blistering the abdomen is often followed by the happiest results.

We are indebted to Mr. Crampton for the particulars of a remarkable case of chronic abdominal disease, where a powerful and extensive revulsion was followed by the greatest relief of symptoms. A lady, who had laboured under ovarian disease, with severe symptoms of chronic inflammation of the mucous membrane of the intestines, as evinced by diarrhœa, bloody stools, tenderness of the abdomen, and emaciation, was severely burned in consequence of her clothes taking fire; the neck, arms, and throat were the seats of the injury. On recovering from this accident, the greatest improvement became manifest in her general health; the bowels became regular, nutrition went on, the ovarian enlargement subsided greatly, and the patient has since enjoyed a state of good health which could never have been anticipated.

For information on the employment of revulsives in diseases of the urinary organs, and in affections of the generative system, we beg to refer to the articles on these subjects. We shall merely remark that many practitioners avoid the application of a blister to the loins in acute irritations of the kidney, such as nephritis or renal calculus, fearing that strangury would be certainly produced. We believe that this fear is quite unfounded, and that the application of a blister to the loins may be constantly had recourse to with the best effect in these cases. There is no evidence to show that strangury is more liable to be produced by a blister to the loins than to any other part; but it is almost certain that in the majority of cases the strangury is owing to the mismanagement of the blister.

The last class of affections in which we shall examine the utility of revulsives is that of fevers. Louis has investigated this subject with his usual precision, by comparing the effects of blisters in cases of typhoid fever which have proved fatal, and in those where recovery took place. In the first class, he found that the mean duration of the disease was not altered by the practice; that no effect, either upon the temperature of the body, or the state of the circulation, could be connected with the action of the blister; that in two-thirds of the cases the cerebral functions underwent no alteration; and that in the remaining third but a very small proportion presented alleviation of symptoms. The examination of the digestive functions showed the same results, so that he concludes that in his cases the action of blisters produced no effect, either on the duration of the disease or the progress of its symptoms. In those cases where recovery took place, he concludes that blisters had no appreciable effect on the disease, and that they perhaps but slightly retarded the convalescence: so that, in connecting these facts with the inconvenience of blisters, he holds that they should be banished from the treatment of typhoid fever.

It is to be remarked, however, that in these cases the blisters were applied, not over the splanchnic cavities, but to the extremities; the conclusions therefore only apply to this particular mode, and afford no reason for banishing the use of blisters from the treatment of typhoid fever. We know, indeed, from experience, that in certain cases their utility is most remarkable. In the majority of cases of fever the attention of the physician is principally directed to remove inflammation or congestions in some of the great cavities, and revulsion is often the only mode left to him of accomplishing his object. Thus in certain cases of coma occurring at an advanced stage of the disease, the greatest advantage is derived from the application of a blister to the head. In catarrhal fever, when copious secretion sets in, and the powers of life are low, we have found, in the Meath Hospital, the most striking advantage from free blistering on the chest, and have never seen any unpleasant result. So, also, where pneumonia occurs in the course of a typhoid fever, the application of a blister, after depletory measures have been used, or where the skin is cool and the powers of re-action are slight, has been frequently successful in ameliorating or removing the disease. Our experience in the Meath Hospital leads us to the conclusion that, as far as the utility of blisters in fever is concerned, we may use them for the relief of the secondary inflammations which occur, with great benefit; always, however, acting on the principles which we have maintained in this article. [See the article Counter-Irritation for much information on this subject.]

William Stokes.

DERIVATIVES. See Derivation.

DIABETES.—Some of the earlier writers on medicine have given different names to the disease which forms the subject of the present article. Thus it has been styled *diarrhœa urinosa, hydrops ad matulam*, *hyderus*, *dipsacus*, *morbus sitibundus*, *fluxus urinæ*, *nimia urinæ profusio*, *polyuria*.

Owing to the excessive secretion and frequent evacuation of urine in this affection, it has also been named *diabetes*, from the Greek word διαβαίνω, which signifies to pass through: and from the circumstance of the urine having generally a smell of honey, and a sweetish taste, the adjective *mellitus* has been employed to denote this character. M. Renauldin, in an able article on diabetes in the Dictionnaire des Sciences Médicales, and afterwards Dr. Prout, insist upon defining diabetes to be "a disease in which a saccharine state of the urine is the characteristic symptom," although the etymological import of the word extends to any affection accompanied with an immoderate discharge of the urinary secretion. It is not the best logic, however, to found a definition upon an hypothesis; and as there are several instances on record of patients dying under all the symptoms of diabetes, yet without the slightest indication of sugar in the urine, we cannot fairly dispose of these by assuming its presence in the latent state; for it may be latent in the most incidental case of hysterical enuresis, and then how could Drs. Renauldin and Prout refuse the name of diabetes to this fortuitous symptom? We make no unfair extension of their hypothesis; and to speak truth, chemists have as yet discovered no good test of either sugar or urea when in small quantities, nor, were they perfect, ought medical men to take their results as defining disease. Diabetes, like every other malady, must not be defined by symptom *a* or symptom *b*, but by the aggregate and concatenation of the leading symptoms. Of these, immoderate excretion of urine and cachectic emaciation seem much more characteristic than sweetness, however general, and which it must be allowed is at times undistinguishable. All the modes of analysis hitherto devised for indicating the vegetable and animal oxides are extremely imperfect, especially when these are intermingled with other oxides; and the most delicate of them seem to consist, not in demonstrating the presence of these oxides themselves, but in generating new bodies, which are supposed to result from the re-union of the primary elements into which the former had been supposed to be reduced by their operation. In every genuine case of diabetes, however, Dr. Prout contends that a careful analysis of the urine will detect more or less saccharine matter, even when the sensible qualities of this fluid fail to point out the least saccharine *impregnation*; for, as Dr. Watt has observed, *sugar may be present*, but so covered with *other substances that it* cannot be at all detected by the taste.

Hippocrates seems to have been altogether ignorant of this affection, for we find no allusion to it in any of his writings; but Celsus, Galen, Aretæus, and Alexander Trallianus, have left us histories of diabetes. The description of it given by Aretæus is particularly clear and minute. These writers, however, looked upon the disease simply as an increased flow of urine, and as proceeding from renal irritation. Galen thought that this affection bore the same relation to the kidneys and bladder as the lientary does to the stomach and intestines. Aretæus considered it a colliquation of the flesh and limbs into urine. He has observed, "that it has the usual urinary course, namely, the kidneys and bladder, for the patients never cease voiding their urine, but as from the openings of the water-ducts, the stream is perpetual." Trallianus adopted much the same view of the complaint. No further light seems to have been thrown upon the nature of diabetes until the time of Willis, who first pointed out the saccharine taste of diabetic urine. "The subjects of this affection," that able writer has remarked, "pass more urine than the whole quantity of fluids taken into the body; they have besides a constant thirst, and a slow kind of hectic fever always on them. It is very far from true, as some authors affirm, of the drink being again discharged with little or no alteration, for the urine in all that I have seen, (and I believe it will universally be the case,) differed not only from their drink, and from every other fluid in the animal body, but was like as if it had been mixed with honey or with sugar, and had a wonderfully sweet taste." Willis has ably investigated the principal phenomena of the complaint, and endeavoured to point out its seat; but he confesses his ignorance of its causes and true nature. He has enumerated a variety of remedies adapted to the removal of the disease, but he admits the difficulty of ascertaining what are the true purposes which ought to be kept in view in its cure. At the commencement of the diabetic tendency, he found a cure by no means difficult; but in the advanced stage of the disease, such a result very seldom occurred. This he supposed was owing to the crasis of the blood being only a little loosened, and thus readily brought back again into its former state; but when so much dissolved as to have most of its parts separated from each other, it could seldom, if ever, be restored. The treatise of Willis upon diabetes has been translated by Dr. Latham, and published in his "Facts and Opinions" concerning that affection.

Sydenham, who lived for several years after Willis, and was cotemporary with him, has not alluded to the sweetness of the urine in diabetes, though he has left an extremely accurate description of its causes and the indications of its cure. We shall not attempt to account for this silence of Sydenham, by supposing, with Dr. Latham, that it arose from any other cause than mere inadvertency. Experiment was then but a new branch of science; and the practice of tasting the urine of a diabetic patient was probably first adopted by Willis, of all men, from the beginning of time; nor would the practical mind of Sydenham consider the announcement of more importance than if he had been told that the urine of hydrophobia was bitter; for what, in his time, was to be learnt from either? After Sydenham, we meet with notices of this affection in the writings of Cullen and Heberden; and since their time many attempts have been made to elucidate its real nature, and to establish a successful mode of cure. Dr. Rollo, however, strongly roused the attention of the profession to the subject by the publication and extended circulation of Captain Meredith's case, in which he proposed a new and important plan of treatment. To that author every praise is due for having enabled us to form more correct notions of the nature and cure of this complaint. The names of Cruikshank, Girdlestone, Fothergill, Dobson, Latham, Baillie, Lubbock, Bostock, Wollaston, Warren, Henry, Bardsley, Watt, Satterley, Prout, and Marsh, [Christison, M'Gregor, Bouchardat, Dezeiméris, R. Willis,] may be mentioned as those of valuable contributors to the general fund of information which we now possess concerning this formidable malady.

It has been supposed that diabetes is a disease of more common occurrence at the present time than formerly, because we meet with so few notices of the complaint in the writings of authors from Willis to Rollo, compared with the numerous authentic records of diabetic cases since the valuable publication of the latter physician. The fact seems to be that the disease is now better understood, and its symptoms are more generally known, so that not a few cases which would formerly have been classed under the head of phthisis or tabes, are now ascertained to be genuine examples of diabetes. Dr. Storer, of Nottingham, states, in a letter to Dr. Rollo, that he had not seen a single instance of diabetes during sixteen years in which he had the case of an infirmary, containing upon an annual average fifty-two in-patients, and three hundred out-patients. In the Manchester Infirmary, diabetic patients not unfrequently present themselves for admission, and it generally falls to the lot of each of the medical officers of that institution to receive several cases under his care during the year. On inquiry, we have found that the same holds true with other extensive public hospitals. In private practice, too, instances of this disease are by no means uncommon; for we believe there are few medical men who have a fair share of professional employment, to whom cases of diabetes have not somewhat frequently occurred. Diabetes occurs in early as well as in advanced life. Heberden erroneously supposed that it exclusively attacked the aged and infirm. We have witnessed two instances of this disease in children under six years of age; and Dr. Venables has also recorded several marked cases of infantile diabetes. A very distinct example connected with the process of dentition, and in which the urine was sweet, is related by Morton. More than half of the cases seen by Dr. Watt,—and he believed the same observation would hold with regard to all that have been published,—occurred between the ages of thirty and forty-five; and of the other half a greater number were below the former of these ages than above the latter. "Of the whole," he says, "the best marked and most rapid in their progress have occurred in the very prime of life, and when the constitution was supposed to be in its full vigour. There is, perhaps, no period of life completely secure from the disease, though few instances have been recorded under the age of puberty. I have met with one instance in a boy of three years of age. It was most distinctly marked; the urine amounted to six or seven pints daily; the voracious appetite, urgent thirst, and arid skin were very remarkable. He had also phymosis, and afterwards suppression of urine. The disease terminated in a fatal dropsy."

This disease not unfrequently makes its approach insidiously; and it unfortunately happens that the first symptoms are often disregarded, and the complaint is allowed to advance for some time uncontrolled by medicine. The increased flow of urine is merely regarded as the necessary effect of the thirst, and the discovery of the saccharine condition of this fluid is also mostly accidental; but when hectic, emaciation, and debility have supervened, a more strict inquiry into the symptoms is generally instituted, and the real nature of the complaint becomes fully ascertained. The almost constant desire to make water, and the insatiable thirst, particularly during the night, are two most distressing symptoms; the patient being obliged to be supplied with a large quantity of fluid near his bed-side, and having to rise six or seven times or oftener to evacuate the bladder. The urine has a slight straw colour, and sweetish taste, and yields on evaporation a considerable quantity of saccharine extract. The amount of this secretion passed during the twenty-four hours is sometimes very considerable. It has exceeded, in more than one instance, seventy pounds. In the case of Smith, detailed in the writer's "*Hospital Facts and Observations*," thirty-six pints of urine were voided in the course of twenty-four hours; and in that of Johnson, thirty-two pints. The discharge, generally speaking, is less than the liquid ingesta; but it has been found in one or two cases, that the liquid egesta have considerably exceeded the whole amount both of the solid and liquid ingesta. This fact, though denied by some writers, has been satisfactorily established by Dr. Bardsley, who has shown that the excess of the former cannot be accounted for solely on the supposition of its being derived from a general wasting and diminution of the solid and fluid parts of the system; for in two or three instances during the period in which the register clearly pointed out almost a regular daily excess in the amount of the urine compared with that of the liquids and solids taken, the patients had gained an accession to their weight of many pounds. "To what law or process of the animal economy," the author just named observes, "is the supply of this superabundant quantity of urine to be attributed? Is it derived from cuticular or pulmonary absorption, or from a colliquation of the humours of the body? Each of these modes has been insisted on by different writers." We receive the fact without framing any hypothesis to account for it. The researches of modern physiologists, particularly those of Klapp and Dangerfield, do however render it extremely probable that this superabundant quantity of fluid is absorbed by the lungs from the moisture of the atmosphere. Numerous observations demonstrate that almost every kind of matter in the state of fluid or vapour, introduced into the cells of the lungs, is rapidly absorbed from thence into the circulation, and, generally speaking, presents itself at the kidneys; thus the oil of turpentine manifests itself in the urine within a few minutes; and the amount of these facts goes to prove that there is a free and rapid absorption always taking place on the surface of the lungs. On the other hand absorption through the cuticle, if it exists at all, cannot be demonstrated; while it is admitted by almost every one, that nine-tenths of the copious exhalation of the pulmonary surface, which, according to proportion, must at least be ten times as great as that by the skin, or twenty pounds daily, is constantly in the act of being re-absorbed by the pulmonary surface: and since the avidity of the absorbents is known to be greatly augmented, as in dropsy, by an increased diuresis, while the pulmonary exhalation must be proportionally diminished, it is easy to conceive that the absorption of the fluid excreted from the bronchi will be considerably increased, and thus augment the quantity of fluid egesta above the ingesta. There will, moreover, be absorption of part of the residual air in the lungs, and this will again supply itself from the now moister air brought in from the atmosphere by inspiration, to what extent it is not easy to compute; nor can we reasonably expect that any such computation will correspond very exactly with the weights of the ingesta and body at different times, the means of taking which are often much more fallacious than is generally believed.

The mouth is mostly dry and parched, the taste is perverted, and the secretion of saliva altered. [Mr. M'Gregor found that it fermented briskly in a diabetic patient, when yeast was added to it, and complaints are often made of a constant sweet mawkish taste in the mouth, and a feeling as if the teeth were set on edge.] A tough viscid phlegm occupies the fauces; the tongue has a brownish fur on its centre, with florid edges; the gums are soft, spongy, and bleed on the slightest pressure of the tongue against them, being mostly ulcerated about the roots of the teeth; the appetite is usually keen, and sometimes ravenous; uneasiness about the stomach and bowels is experienced, chiefly after eating, and the contents of the former are not unfrequently discharged in an acid and undigested state; the skin is rough, dry, and unperspirable; the bowels are generally costive; there is frequent pain and a constant sense of aching and weakness across the region of the kidneys, particularly on the least exertion; itching and excoriation, with phymosis of the prepuce, occurs in males, and an uneasiness about the meatus urinarius in females; the semen is discharged involuntarily, chiefly after voiding urine; and there is a total loss of the sexual propensities. Headach, impaired hearing, giddiness, and indistinct vision, are mostly present. When these symptoms continue only for a short time, they are followed by serious disturbance in the general health, such as extreme debility, languor, and great emaciation. The pulse, which is at first quicker than natural, becomes slow and feeble. The legs and ankles swell; and a tickling cough, with shooting pains in the chest, mostly harasses the unfortunate patient in the last stage of his disorder. The mind is extremely peevish, irritable, and somewhat suspicious; the spirits are low and depressed.

By attention to the above symptoms, it is not, we conceive, difficult to distinguish diabetes from every other disease. There may be a preternatural discharge of urine in other affections; but *in this only* is a saccharine condition of that secretion present. Most of the more severe symptoms of this disease are attributable to the immense amount of solid matter which is constantly draining off from the body; and indeed some diabetic patients seem to sink merely from the debility occasioned by the continued secretion of an unnatural quantity of urine containing so large a proportion of animal extractive matter. The appetite, though voracious, is inadequate to the supply of nourishment sufficient to balance the immense and rapid waste which is daily taking place. "The loss of so much matter," Dr. Elliotson observes, "from the system, sufficiently explains the hunger, the feeling of emptiness and sinking in the stomach, the emaciation, debility, anaphrodisia, coldness of the legs, pain both of them and of the loins, the depression of spirits, &c. without attributing the disease to the stomach or the kidneys exclusively. The excessive escape of fluid, or when this does not take place, the feverishness, equally explains the thirst and dryness of the skin."

It will be shown, when we come to the consideration of the pathology of diabetes, that it is mostly complicated with disease in some important organs. Dr. Willan observed that he never met with a confirmed case of this disease in which there was not some considerable disorder of the constitution, or a defect in some organ essential to life. Our experience leads us to hold this remark as not far removed from truth; although it may be said that the constitutional affections are more frequently the effects of the progress of diabetes, than the concomitants of its commencement. Pulmonic affections, we know, not unfrequently precede or accompany diabetes. Dr. Bardsley remarks that he scarcely recollects an instance of the disease where a slight affection of the chest did not more or less prevail. In several instances, too, on record, a connection between phthisis pulmonalis and diabetes is strikingly marked. The phthisical symptoms existing previously to the attack of the latter disorder are often suspended by its influence; but on the partial removal of the diabetic complaint, the tubercles pass rapidly through their several stages, and the patient's sufferings are terminated by death. A similar suspension of the progress of disease in the lungs is sometimes noticed in females who become pregnant whilst labouring under the symptoms of confirmed phthisis. The cough, expectoration, and hectic fever, almost entirely disappear, pregnancy advances, and labour ensues; when in the course of a few weeks (sometimes days) the pulmonary symptoms return with aggravated severity, the strength rapidly declines, and life is soon extinct. In the more confirmed cases of this disease which have fallen under our notice, there has been generally present a teazing tickling cough, sometimes attended with purulent expectoration, and mostly with dyspnœa, and shooting pains in the chest.

The most common exciting causes have been, according to our experience, frequent exposure of the body to sudden alternations of heat and cold, and an indulgence in copious draughts of cold fluid when the system has been over-heated by labour or exercise. In twelve cases that have come under our observation, the patients have attributed their ailment to one of these causes; hence, we have observed this affection chiefly amongst that class of artisans whose occupations expose them to sudden changes of temperature, or who reside in damp and low situations. The intemperate use of spirituous liquors, poor living, and distress of mind, not unfrequently operate, too, in the production of this disorder. It is a curious analogous fact, that dogs and rabbits fed upon rye-meal, or on decoctions of wheaten flour, have a species of diabetes produced; as has been ascertained by the experiments of Dr. Krimer of Hallé. The secretion of urine becomes much increased: the urea and uric acid almost or altogether disappear; the animal becomes emaciated; and in place of sugar, the urine is found loaded with albumen and mucus. The origin of the complaint has been traced by some patients to sleeping out the whole of the night in the open air, in a state of intoxication. The subjects of this disease have been mostly liable to profuse sweating upon any ordinary exertion, and at such times have been accustomed to abate thirst by drinking freely of cold liquids, or by eating immoderately of acid fruits, thus suddenly checking perspiration. The state of the mind seems to have a more intimate connection with this affection than has been generally supposed. In several cases on record, mental anxiety and distress have been assigned as its chief cause. Indeed, a temporary diabetes insipidus is a very ordinary effect of such a state, and the despondency of mind throughout the disease is distinctly alluded to by Aretæus, and by many other eminent writers.

We have not observed the characteristic odour, compared to that of hay, from the persons of diabetic patients, to which Dr. Latham has particularly alluded. It has been supposed that the phymosis before noticed as a symptom of diabetes, proceeds from the extreme sensibility of the urethra, which subjects it to the general irritation of the system so frequently present in the complaint, and thus renders it morbidly sensible to the stimulus of the urinous fluid.

With respect to the emaciation, it may be remarked that Dr. Lubbock considered it a leading circumstance in this affection: for in his experience it came on slowly, the subject of it not perceiving much deviation from health. "I have at this time," he observes, "two patients who, excepting a slight and very gradual wasting of the body, some increase of thirst, with occasional uneasy sensations about the stomach, to which may be added, feebleness of sight at times, and an habitual tendency to phymosis, possess that degree of apparent health and strength that would mislead a common observer." He conceived that the emaciation claimed the first attention of the physician; as without the removal of this symptom, neither the reduction of the urine, the alteration of its quality, nor the appearance of considerable remaining muscular power, could prove that the disease had yielded to any curative process.

Diabetes frequently occurs in the scrofulous habit, but is not confined to it alone. Some authors are of opinion that the disease may be hereditary; thus Dr. Prout observes, he cannot doubt but that a predisposition or tendency to this affection exists in some families, as he has witnessed four distinct instances of such a circumstance. The first was that of a young man whose mother and uncle had died of the disease; the second was that of a lady about fifty years of age, whose brother or sister had sunk under the complaint; the third was that of a girl about ten years of age, whose father two or three years before had died of the same affection; the fourth instance was that of a gentleman, aged fifty-four, who died of this affection, and whose father had laboured under the same disease for several years. Dr. Storer has noticed the occurrence of three cases of diabetes in one family, in the persons of a brother, sister, and her daughter. The father of the two elder died of that affection. In another instance, related by Mr. Leigh Thomas, three brothers in one family laboured under diabetes. Morton has also alluded to the hereditary nature of the disease. We believe that a tendency to it is occasionally inherited; but further experience and a more extended inquiry on this point are necessary, before diabetes can be correctly arranged like scrofula, phthisis, mania, and apoplexy, under the head of *family* diseases; for in not a few instances no hereditary origin can be traced. Yet, it must be observed, that even of these diseases, no two have exactly the same hereditary influence, nor are any two of them modified exactly in the same degree by circumstances;

while all of them are seen to spring up every day in cases where no hereditary taint can be suspected; so that, if a comparatively rare disease like diabetes has been found by Dr. Prout hereditary in four times out of twenty, it seems fair to admit, that, as in the case of a great many other diseases, its supervention is often greatly favoured, if not determined, by hereditary conformation; and little more can be said even of scrofula or mania.

Various opinions have been formed concerning the *proximate cause* of diabetes. Thus some authors of eminence, like Mead, have supposed that it depends on a "morbid state of the liver and bile;" some, as Dobson, Home, Cullen, and Rollo, believed that it proceeds from a defect in the assimilatory organs; whilst others, as Dupuytren and Thenard, have attributed the principal phenomena of the disease to a "morbid action of the kidneys." Dr. Baillie also thought it probable that diabetes was owing to a deranged action of the secretory structure of the kidneys, by which the blood there is disposed to new combinations; and that the effect of these combinations was the production of a saccharine matter. He at the same time imagined that the chyle might be so imperfectly formed as to cause the blood to be more readily changed into a saccharine substance by the action of the kidneys. The ingenious author of the Zoonomia conceived that diabetes was produced by a retrograde motion of the absorbent vessels, owing to which chyle passed from the lacteals into the lymphatics of the kidneys or bladder. Cawley thought that in this disease the tubuli uriniferi were enlarged or relaxed, by which the chyle escaped into the urine. Willis concluded that diabetes depended upon a dyscrasy or intemperament of the blood, resulting from a morbid action of the assimilating powers. "Thus," he observes, "diabetes is rather and more immediately an affection of the blood than of the kidneys, and it thence has its origin, inasmuch as the mass of blood becomes, as it were, melted down, and is too copiously dissolved into a state of serosity, which indeed is very manifest from the quantity of urine so immensely increased, which cannot arise from any other cause than from this solution and waste of the blood: whence also the blood, which is left in the body, the serum being thus copiously abstracted from it, becomes much thicker and more apt to coagulate, as we may infer from the quick and laborious pulse; for on that account the heart acts with more rapidity, that the blood, which it thus agitates more than is usual, may be preserved from coagulating." The two hypotheses, however, which refer the seat of the disease to a morbid action of the stomach, and a morbid condition of the kidneys, have been most generally adopted. "Were I to give a theory," says Dr. Home, "to explain the nature and symptoms of this wonderful disease, I would say that it arises from a defect of the animal or assimilatory process, by which the aliment is converted into the nature of our body."

Dr. Home considered the excess or defect of this process as the source of many disorders. Rollo, too, observes that the immediate cause of diabetes mellitus is a morbid condition of the stomach, forming or evolving from vegetable substances saccharine matter, which is quickly separated as a foreign body by the kidneys. "But, to be more particular," he continues, "we allege that this disease consists in an increased morbid action of the stomach, with too great a secretion, and an alteration in the quality of the gastric fluid, producing saccharine matter by a decomposition of the vegetable substances taken in with the food, which remains unchanged." It has been urged, and with reason, as a very serious objection to the theory of Dr. Rollo, that no sugar has been detected in the blood of diabetic patients; a fact which we shall shortly show to be established by the interesting experiments of Wollaston, Marcet, Nicholas, Gueudeville, Thénard, Bostock, Vauquelin, Segalas, and other able chemists.

In several instances of the disease which have come under our own examination, there certainly has been ample evidence of preceding stomach derangement; but admitting that the stomach is generally in a state of morbid activity, as may be inferred from the increased and almost insatiable appetite which accompanies the disease, still we are ignorant of the particular condition of the primæ viæ which leads them to favour the extraction of sugar. Dr. Henry thinks that the theory must be modified by assuming that the blood which reaches the kidneys contains *the elements* of sugar, and is deficient in those *of urea. He* supposes, however, that it is *necessary to a just* pathology of the disease that *some morbid condition* of the kidneys should be admitted, though of a kind which has not yet been explained by anatomical investigation.

Dr. Mason Good conceived that a morbid and highly irritable state of the kidneys was sufficient to account for every other derangement that marks the progress of the disease. He saw no necessity for supposing an idiopathic affection of any other part, whether the stomach or the nerves, the digestive or the assimilating powers; but decides, from the attention which he has paid to the nature of diabetes, both in theory and practice, that the whole of its phenomena may be traced to renal mischief, and consequently that it is a far less complicated affection than has hitherto been supposed. That the kidneys are frequently in a state of irritation is evident from the pain, heat, and weakness, experienced in those organs, and the augmented urinary secretion.

Dr. Lubbock seems to have noticed the coincidence of the parched and dry skin with the saccharine quality of the urine, from which he was induced to believe that in this affection the want of perspiration or excretion from the surface is connected with sweetness of the urinary fluid; and this belief was supported by an examination of the nature of the perspirable fluids, and of the component parts of saccharine matter. On this view he has formed a theory of diabetes. "It has been proved," he observes, "that sugar is, for the most part, composed of carbon, oxygen, and hydrogen, united in a certain ratio; and it appears, by the experiments of Cruikshank and Abernethy, that, besides the occasional aqueous fluid discharged daily from the surface of the body, about three gallons of carbonic acid are also lost to the system by the perspirable matter. Now supposing, as happens in diabetes, this perspirable excretion, or carbonic acid, is suppressed and retained in the system, it is probable that the carbon and oxygen of the acid so retained, by entering into a due combination with some portion of the hydrogen of the animal body, may tend to the production of the saccharine matter of the urine; and as the carbonic acid is the general product of the vegetable world, it would follow that its retention in the animal body may produce the phenomena of the defective animalization, characterising diabetes as exhibited in the formation of sugar."

Dr. Latham has broached a very fanciful hypothesis concerning the proximate cause of diabetes, founded chiefly on the dyscrasy of Willis, and the selecting power of the kidney. As it is impossible to condense it, we shall be satisfied with merely mentioning that it is quite as untenable as some of its ancient predecessors. Dr. Ferriar has also given a very vague opinion in explanation of the phenomena of this disease. He supposes that if the extreme vessels should from any cause take on a morbid action, and, instead of supplying nutritious matter, should form a substance which cannot be applied to renew the waste of the system, the diseased secretion must either accumulate in the intermediate passages of the circulation, where it would produce hectic fever, (by absorption,) and subsequently death; or it must be carried off by some of the emunctories, to which its stimulus must cause an increased determination of fluids. This he conceives to be precisely the case in diabetes. He afterwards refers the secretion of saccharine matter in the kidneys to metastasis, and supposes it to arrive there by the circuit of anastomosing branches.

In a reply to some strictures of the reviewer in the Medical and Physical Journal, on a case of diabetes related in the sixth volume of the Edinburgh Medical and Surgical Journal, the editor observes that the discharge in diabetes may be a diversion of a profuse secretion from the skin to the kidneys; that besides being morbidly profuse, it is, like other secretions, susceptible of a change, and may become stimulating even to the skin itself, and consequently much more so to the kidney, where it then must certainly act as a foreign body exciting the organ to extraordinary action; and that in the enlarged and excited state of the vessels of the kidney, time is not allowed for the secretion of urine to be perfect, and that chyle may pass off with it, or it may be called the urine of digestion or of the chyle, which in the healthy state is passed two or three hours after a meal, and cannot be considered a natural secretion. M. Dezéimeris supposes that the proximate cause or essence of diabetes consists in irritation of the kidneys; that this irritation is rarely primitive, being mostly the result of chronic gastritis. In the course of the latter affection there is extreme thirst; the patient drinks freely, and the urine is in proportion: this state is prolonged; the activity of the kidneys increases every day at the expense of that of the other excretory organs; they remove from the body those fluids which require constant renewal, and thus again contribute to augment the thirst.

Such are only a few of the hypotheses which have been framed to explain the nature of diabetes; but they are sufficiently numerous to show how little is really known respecting it. One great cause of this diversity of opinion is, as we shall hereafter show, the defective aid afforded by pathological investigation. "Pathological anatomy," as the late celebrated Laennec justly remarked, "is incontestibly the surest guide of the physician, either in the recognition of maladies, or in the cure of those which are susceptible of cure." We have no theory of our own to propose; but from all the attention which we have been able to pay to the subject, and from what we have seen of the disease itself, it appears to us proper to admit that the natural and healthy action of *both the stomach and kidneys* is materially disturbed; the former perhaps primarily, and the latter secondarily; and that the *dry and unperspirable condition of the skin* is much more intimately connected with its production than is generally supposed: thus diabetes is an affection not proceeding from a morbid action of one particular part, but of several important organs. This statement is sanctioned by facts, and seems to derive confirmation from the symptoms, the remote causes, the effects, and analogy with other diseases. We have used the word *perhaps* in the above allusion to the primary derangement of the stomach, because in several diabetic cases on record the increased secretion of urine preceded every other symptom. So constant is the sympathy between the kidneys and the stomach, that Sydenham himself has declared there is no other mean of distinguishing between nephritis and lumbago than the expression of this sympathy in the former case by vomiting. It is possible that increased action of the kidney may very early, though not primarily, call the stomach into sympathy. In a communication from our friend Dr. Milligan of Edinburgh, he remarks that the famous Peter Petit asks, in his Commentary upon Aretæus, if the excess of sugar is furnished by an error of the digestive process, why does it not pass off by the bowels, the lungs, or the skin, as well as by the kidney? "But this very profound and philosophical question is very easily answered by the practical observation, that we know, as a matter of experience, that any excess of fluid introduced into the circulation does not readily pass off by the skin, lungs, or bowels, but seems naturally and designedly in almost every instance to be carried away by the route of the kidneys and urinary passages; and that, therefore, we have a right to expect that it will be so here. But it does not follow from this that the *first* profusion of urine in diabetes is saccharine, nor yet that the initial steps of the malady are to be traced to errors in the action of the stomach or the skin: nay, so great is the number of persons who at all times labour under disease of the two latter organs, that on diabetes commencing we should require very strong proofs that some aggravation of the morbid condition of these parts, unconnected with any suddenly interposed cause, took place at the time, before we admitted that they were instrumental in producing diabetes."

[For some other views on the nature of Diabetes, see page 617.]

We must next allude to the *prognosis* to be generally formed in this malady. It has been morbid condition, consequent on the occurrence of a new irritation or excitation of action *not* artificially produced. Thus when a blister is applied in a case of pneumonia, with relief of the pulmonary disease, we have an example of the first acceptation; and when a disease of the lungs subsides on the occurrence of a cutaneous eruption, or of a diarrhœa, we have an instance of the second. In either case the principal pathological phenomenon is the change of the seat of irritation or excitement.

The term *revulsion* is one better adapted to express this phenomenon, but it matters little which phrase we adopt. The older authors entered into many arguments respecting the difference between revulsion and derivation, but as their ideas on these subjects were founded on false physiological views, we shall pass them by here.

The circumstances under which derivation, as taken in its first acceptation, is observed, may be thus enumerated.

First, the application of agents to the two great surfaces of relation, namely, the skin and mucous membranes, calculated to irritate or merely increase the normal action of these tissues; and secondly, the use of stimulants calculated to excite the secretions of various of the parenchymatous organs. Under these heads may be enumerated all the irritating applications which we make to the skin, such as cantharides, ammonia, tartar emetic, &c., and also the use of friction and heat. When we employ purgatives to cure a dropsy, or a disease of the skin or of parenchymatous organs, when we use diaphoretics to relieve a mucous inflammation, or diuretics to remove serous effusions, we act on the derivative or revulsive system, and the remedies are in all cases derivatives or revulsives. In some of these cases, we cure or alleviate the original disease by the production of a new inflammation in the part acted on, as in the case of blistering; in others, the part acted on is not made the seat of a new inflammation, but its normal secretion is excited and increased, as in the case of warm bathing producing diaphoresis.

The second example of artificial derivation is the production of irritation in tissues deeper seated than the skin, but still exterior to the viscera. Of this, the use of setons and issues is an example.

But, as we have already shown, derivation or revulsion is often found to occur independently of any artificial excitation, and the consideration of this subject comes to be of the highest interest in medicine. As, however, it is more immediately connected with metastasis, we shall in this place merely sketch the leading physiological facts connected with this species of derivation. One of the most interesting of these is, that this revulsion often occurs between analogous tissues; thus, in cases of inflammation of the synovial membranes, the sudden subsidence of the disease is commonly followed by inflammation of some of the serous membranes, such as the pericardium, peritoneum, pleura, or arachnoid. Again, a patient has diarrhœa; this suddenly subsides and is succeeded by violent bronchitis; he has a disease of the skin, which is repressed, and the mucous membranes become engaged, or *vice versa*. But this rule is by no means so general as to form a law in pathology, for we find very many instances of exception; for example, the occurrence of ascites after suppression of the perspiration, hemorrhage from the kidneys after the desquamation of measles; the alternation of catarrh and hemiplegia; of gout and gastro-enteritis, or bronchitis; of mania and œdema of the lower extremities.

We shall not here examine the relation of cause and effect in these examples of conversion of disease; it may suffice to remark, that in some cases the subsequent or secondary disease appears to arise from the cause so well illustrated by Broussais, namely, the predominance of the sympathetic over the primary irritation; while in others it seems to result from a morbid condition of the whole system, consequent on the subsidence or removal of some local irritation, which, from its chronic duration, has apparently become necessary for the proper balance of the constitution.

Two modes of revulsion are used in medicine. In the first, we endeavour to change the seat of irritation or excitement from the viscera to the surface; in the second, we change it from one viscus to another. The first may be called the exterior or peripheral revulsion; the second, the interior or visceral. To the first of these we shall in this article principally direct our attention.

The modus operandi and therapeutic application of the exterior derivatives are questions of great interest in medicine. In some cases the application of a blister to the surface is followed by great relief of the internal disease, while in others the reverse occurs. To determine the cases in which the favourable or unfavourable results may be reasonably expected, comes to be a great desideratum. Here experience is our chief guide. It has been long known that blisters will relieve local inflammation of the internal parts under three circumstances; *first*, where the disease is of the acute character, but modified in its intensity by active antiphlogistic measures; *secondly*, where it is acute, as respects the time, but occurring in cases where the powers of life are low, as in typhoid inflammations; and, *lastly*, in chronic diseases. In all these cases, the activity of the capillary circulation in the diseased part is weak, and revulsion taking place with ease, a rapid removal of the local disease is often the effect of our treatment. On the injurious effects of external revulsives in acute inflammations, before depletion is used, most authors are agreed. Rostan, in his Clinical Medicine, says, "Revulsions are generally contra-indicated in the early stage of acute diseases when there is fever and the subject is young and strong." The same author, in another place, says that although a derivative effect is often obtained, yet that in many cases excitation will follow the use of revulsives, and an effect directly contrary to that expected will be produced. Mr. Porter, in his "Surgical Observations on the Diseases of the Larynx and Trachea," expresses himself strongly against the use of blisters in acute laryngitis, particularly when applied to the neighbourhood of the part. He says, they cannot be resorted to at an early period without considerable risk of doing mischief. A case is related, where, in acute pneumonia, the application of a blister was followed by an aggravation of the symptoms and death. On dissection, a portion of the surface of the lung, exactly corresponding to the size and shape of the blister, was found in a more advanced stage of inflammation than the remaining pulmonary tissue. Many other authors might be quoted to the same effect. Our own experience is decidedly in favour of these views. We have often seen a distinct exacerbation follow the application of a blister in the acute pneumonia, bronchitis, or gastro-enteritis of children, in cases where bloodletting was not used; and many medical friends have informed us of similar occurrences in their own practice. Even in a few chronic cases we have observed the same effect where local bleeding has not been premised.

We must, then, admit that external derivatives have two modes of action; the one derivative, the other directly stimulant on the diseased part. We find them, as we stated before, generally useful in three sets of cases, namely, acute inflammations where general and local bloodletting has been premised, typhoid inflammations, and chronic diseases: and it becomes probable that a *part* at least of their utility is owing to the direct stimulus conveyed to the capillaries of the diseased tissue. A state of these vessels, analogous to Andral's *asthenic hyperæmia*, in all probability exists, and we know that stimulation is often the best mode of removing this morbid condition. This will account for the injurious effects of external revulsives in acute cases before depletion has been used, and is not inconsistent with their good effects in cases of a different description. They are all essentially stimulants. If the irritability of the system is great, an increase of fever will be the result of the sympathetic irritation of a blister, and in this way the local inflammation will be aggravated. Whether the increase of the local disease be always owing to this cause, or whether it may occur without the intervention of sympathetic fever, are questions of difficulty, but happily not of great practical importance.

We often find, in cases of intense irritation of internal organs, that blisters will not vesicate the skin, but that, as soon as the disease has been modified, they will produce their usual effect. Can this be explained by supposing, that in consequence of the intense inward determination, the surface has lost a portion of its vitality? In such cases, the vesication of the surface is often not the cause, but the consequence of the diminution of diseased action.

The means generally employed to produce external revulsions are the application of blisters, sinapisms, or the tartar emetic ointment; and the use of setons, issues, the moxa, heat, and friction. In this country the most common mode is the application of blisters, either immediately over the diseased organ, or at some distance from it. Unpleasant consequences often follow even this simple proceeding; of which the principal are the infliction of great pain, the production of a too violent inflammation, and the occurrence of strangury. All these bad effects appear frequently to arise from the practice which commonly prevails of allowing the blister to remain on for twelve or even twenty-four hours; a mode of proceeding totally useless, and constantly injurious.

Dr. Leahy, the learned Professor of the Practice of Medicine in the School of Physic in Ireland, has long inveighed against this practice. His mode is to remove the blister as soon as decided pain is produced, although the part be not vesicated. Simple dressings are then applied; and free vesication subsequently occurs; and in the majority of cases none of the distressing effects alluded to are produced. We can speak from our own experience of the superior efficacy of this mode, and feel strongly disposed to believe that were it more constantly pursued, we would see fewer cases of the aggravation of internal disease from the use of blisters.

These views are also much insisted on by M. Bretonneau, in his Traité de la Diphtherite. His mode of using blisters is peculiarly elegant, being founded on the experiments of Robiquet, which show that the vesicating principle is soluble in fatty substances. A piece of extremely thin paper is inserted between the blister and skin, through which of course the oily solution penetrates. Many of the inconveniences of the common mode of blistering are avoided, such as the long-continued irritation that portions of the cantharides produce by sticking to the part; the unsightly marks which blisters leave, &c.: and M. Bretonneau states that during six years' practice in his hospital, there did not occur a single case of ischuria after blistering performed in this way.

Some practitioners, particularly on the Continent, prefer applying blisters always at some distance from the seat of disease; in this way, according to their opinion, avoiding the danger of direct stimulation. Facts are still wanting to enable us finally to determine on the relative merits of these two modes of proceeding; but if the use of a blister over a part affected with acute inflammation is avoided until its capillary irritation has been modified by antiphlogistic treatment, we believe that the practice will generally be found safe.

The use of the tartar emetic ointment, as recommended by Jenner, has now become very common. In some cases, however, it is productive of great distress, in consequence of the formation of large and angry pustules; a circumstance in most cases arising from the use of too great a quantity of the salt in forming the ointment. A drachm to the ounce of lard is the usual proportion; but if we employ a diminished quantity, the remedy will act much better, and frequently with little or no distress to the patient. From a scruple to half a drachm of the salt, finely pulverised, is generally sufficient; and in this way an extensive eruption of minute pustules will be produced, from which we have never seen any unpleasant consequences to follow. An extraordinary effect of this mode of counter-irritation has been several times observed, namely, the supervention of violent irritation about the parts of generation. At first it was supposed that the irritating substance was directly conveyed to the parts by means of the patient's hands; but this opinion is untenable, as the eruption has occurred in cases where the greatest caution was used to prevent any direct conveyance of the ointment to the genitals. This circumstance is noted by Dr. Mackintosh, in his Practice of Physic; and both

Dr. Graves and the writer of this article have had frequent opportunities of observing it in the Meath Hospital. In a case which occurred in private practice, the inflammation about the genitals in a young female was so severe as to threaten mortification. Another unpleasant result of this mode of counter-irritation is the occurrence of violent and obstinate vomiting, particularly where the ointment has been rubbed over the epigastric region.

We shall now proceed to consider the use of external revulsion in cases of visceral disease. Authors appear to agree as to the impropriety of using revulsives in cases of disease of the brain when it is acute, and particularly where bloodletting has not been premised; thus fully bearing out the doctrine which we have endeavoured to support in this article.

In diseases of the brain and spinal marrow, all the different modes of revulsion have been practised with great success. Indeed, with the exception of the first stage of acute irritations, it may be said that revulsives are of the highest utility in all cerebral diseases, whether functional or organic: where coma supervenes, and in chronic affections, the best results often follow this practice. Thus in all the forms of paralysis depending on disease of the brain and spinal marrow, the various revulsives have long been recognized as among our best remedies; and they may be often employed as prophylactics, as in cases where an apoplectic disposition decidedly exists, and where the life of the patient may be prolonged by the timely use of a seton in the neck.

Dr. Jenner, in his letter on the influence of artificial eruptions, speaks in the highest terms of the utility of the tartar emetic ointment in the cure of insanity, declaring that in all his cases (eighteen in number) this treatment succeeded in removing the disease. Dr. Burrows, however, is by no means so sanguine; but states that in cases where insanity has ensued on the subsidence of a cutaneous eruption, or is connected with gastric irritation, this treatment will ameliorate the symptoms. He prefers the use of the tartar emetic ointment to that of blisters.

In Lallemand's "Lettres sur l'Encéphale," a case is recorded highly illustrative of the effects of powerful revulsion under the most unfavourable circumstance. A patient, upwards of sixty years of age, became affected with symptoms of encephalitis, in consequence of an injury of the head. The prominent symptoms were stupor, paralysis with convulsions of the right arm, embarrassment of speech, and loss of memory. The circumstance of the injury of the head being unknown to his medical attendants, the case was considered as an example of idiopathic fever, until the tenth day, when the patient was seen by M. Lallemand for the first time. The patient had then frequent and long-continued fainting fits; the limbs on the right side were contracted, with complete paralysis of sensation; the eyelids closed, the eyes divergent and insensible to light; there was complete loss of hearing and intelligence; the body was covered with a cold sweat; the respiration frequent and stertorous; and the pulse imperceptible. In this desperate state, Lallemand applied boiling water to the legs of the patient. The first application produced a sudden motion of the whole body; the left arm was agitated, the eyelids were raised, and the pulse became perceptible in the arm. In the course of half an hour the boiling water was applied to the thighs with still more remarkable effects: the face became red, and the pulse full and frequent. Ice was now applied to the head, and in two hours the sensibility was so so much restored that the patient frequently attempted to remove the cold application. Under this treatment, with the occasional application of a few leeches to the head, the patient was nearly restored in the course of eight days; and in two months all paralysis had disappeared. The eschars produced by the boiling water were very deep, and suppurated abundantly, seven weeks elapsing before cicatrization took place. Dr. Mackintosh, in his Practice of Physic, details a case of severe cerebral affection in fever, where the best results followed a similar practice. In this case, however, neither paralysis nor coma had taken place.

In the employment of revulsives in diseases of the brain, it appears most proper to select for the place of stimulation some part remote from the cranium. In this way the action of the revulsive can be powerfully assisted by the application of cold to the head, as by the use of ice, or, what is still better, the cold affusion, used in the manner directed by Dr. Abercrombie.

We may here notice the practice of counter-irritation along the spinal column, as proposed by Mr. Teale for the cure of hysteric affections; and which, according to him, has been followed by the best effects. It would appear, however, that as yet a sufficient number of observations has not been made to establish the pathological views on which this practice is founded. Doubtless, cases of spinal irritation do occur where the use of revulsion may be followed by the best results. In veterinary practice we have known good effects obtained, in cases of tetanus, by the use of severe counter-irritation along the spinal column.

In diseases of the respiratory organs, whether of the mucous membrane, parenchyma, or serous investment, revulsions have long been employed by physicians. The same principles which guide us in the use of revulsives in diseases of the brain are found to apply here:—improper in the acute stage, and even dangerous when the irritation has not been reduced by antiphlogistic measures, they are found generally of the highest utility in cases where the lancet has been used, and where the inflammation is of an asthenic or chronic character. In simple acute laryngitis, the best authors agree as to the impropriety of using blisters to the anterior portion of the neck. Guersent and Porter express themselves most strongly on this subject; the former, however, admitting that they may be useful in the *asthenic croup;* but he prefers employing them at a distance from the affected part. Indeed, there are few diseases where so much caution should be used in any mode of treatment which would have a chance of increasing irritation; as we know that a momentary spasm of the glottis may suddenly extinguish life. In an irritable patient, then, we must be extremely cautious in the employment of the revulsive mode. But in chronic laryngitis we find the best effects from counter-irritation in the neighbourhood of the part;

repeated blistering, frictions with the tartar emetic ointment, and the use of the seton, being among our most successful modes of treatment in this obstinate disease.

The good effects of severe counter-irritation in a case of chronic laryngitis of long standing, and which threatened the life of the patient, were strikingly exemplified some time ago in the Meath Hospital. The symptoms were extremely urgent, and were not alleviated by local bleeding. Two blisters, of about two inches wide and five in length, were applied along the course of the sterno-mastoid muscles, and the vesicated surface sprinkled with finely powdered tartar emetic. A most severe counter-irritation was thus produced; the patient suffered extremely; but the laryngitis was completely removed, and we believe the cure was permanent.

In diseases of the lungs we find the same general principles equally to apply. We have seen many instances where the symptoms of acute pneumonia or pleuritis were clearly aggravated by the empirical use of blisters; but in the second state of acute bronchitis, in most of the forms of chronic catarrh, in hooping-cough, in hepatizations, or passive congestions of the lung, and in the advanced stages of pleurisy, the revulsive practice is almost always followed by the best effects. The utility of the same practice in cases of chronic phthisis is so well known that we need not comment on it here.

One of the most distressing circumstances in the progress of a case of hypertrophy of the heart, is the occasional increase of palpitations and præcordial distress: this is frequently relieved by the application of a blister; a circumstance which, combined with our knowledge of the efficacy of local bleeding in similar cases, adds greatly to the probable correctness of Andral's opinion, that in many such cases the cause of these symptoms is an irritation of the internal membrane of the heart.

In the examination of the effect of external revulsion in diseases of the digestive system, we must consider its employment in affections of the mucous and serous membranes. Broussais, in his Phlegmasies Chroniques, endeavours to establish that in inflammations of the mucous membrane, both acute and chronic, such practice is always improper, and that those cases of altered function which are relieved by vesication of the surface, are not in reality examples of inflammation of the mucous membrane. This assertion, however, appears too general; both analogy and experience lead to the conclusion that in acute gastro-enteritis the use of revulsives to the surface will be probably followed by bad consequences, but this is far from applying to the chronic affections, where we know that this practice is constantly productive of the best effects. In schirrhus of the stomach, in chronic diarrhœa, or dysentery, in tabes mesenterica, the great utility of external revulsives has long been established; so that, as far as the affections of the gastro-intestinal mucous membrane are concerned, the general principle which we have been endeavouring to establish is also borne out. In point of fact, Broussais does not seem to be sufficiently aware of the utility of stimulation in the internal as well as the external chronic inflammations.

The same conclusions are to be drawn in the case of peritonitis. In the violent acute disease, and particularly before general and local bleeding has been freely premised, a blister often aggravates the symptoms; but in the chronic and asthenic forms of the disease, as in the low puerperal peritonitis described by Dr. Cusack and Dr. Gooch, it is found that blistering the abdomen is often followed by the happiest results.

We are indebted to Mr. Crampton for the particulars of a remarkable case of chronic obdominal disease, where a powerful and extensive revulsion was followed by the greatest relief of symptoms. A lady, who had laboured under ovarian disease, with severe symptoms of chronic inflammation of the mucous membrane of the intestines, as evinced by diarrhœa, bloody stools, tenderness of the abdomen, and emaciation, was severely burned in consequence of her clothes taking fire; the neck, arms, and throat were the seats of the injury. On recovering from this accident, the greatest improvement became manifest in her general health; the bowels became regular, nutrition went on, the ovarian enlargement subsided greatly, and the patient has since enjoyed a state of good health which could never have been anticipated.

For information on the employment of revulsives in diseases of the urinary organs, and in affections of the generative system, we beg to refer to the articles on these subjects. We shall merely remark that many practitioners avoid the application of a blister to the loins in acute irritations of the kidney, such as nephritis or renal calculus, fearing that strangury would be certainly produced. We believe that this fear is quite unfounded, and that the application of a blister to the loins may be constantly had recourse to with the best effect in these cases. There is no evidence to show that strangury is more liable to be produced by a blister to the loins than to any other part; but it is almost certain that in the majority of cases the strangury is owing to the mismanagement of the blister.

The last class of affections in which we shall examine the utility of revulsives is that of fevers. Louis has investigated this subject with his usual precision, by comparing the effects of blisters in cases of typhoid fever which have proved fatal, and in those where recovery took place. In the first class, he found that the mean duration of the disease was not altered by the practice; that no effect, either upon the temperature of the body, or the state of the circulation, could be connected with the action of the blister; that in two-thirds of the cases the cerebral functions underwent no alteration; and that in the remaining third but a very small proportion presented alleviation of symptoms. The examination of the digestive functions showed the same results, so that he concludes that in his cases the action of blisters produced no effect, either on the duration of the disease or the progress of its symptoms. In those cases where recovery took place, he concludes that blisters had no appreciable effect on the disease, and that they perhaps but slightly retarded the convalescence: so that, in connecting these facts with the inconvenience of blisters, he holds that they should be banished from the treatment of typhoid fever.

It is to be remarked, however, that in these cases the blisters were applied, not over the splanchnic cavities, but to the extremities; the conclusions therefore only apply to this particular mode, and afford no reason for banishing the use of blisters from the treatment of typhoid fever. We know, indeed, from experience, that in certain cases their utility is most remarkable. In the majority of cases of fever the attention of the physician is principally directed to remove inflammation or congestions in some of the great cavities, and revulsion is often the only mode left to him of accomplishing his object. Thus in certain cases of coma occurring at an advanced stage of the disease, the greatest advantage is derived from the application of a blister to the head. In catarrhal fever, when copious secretion sets in, and the powers of life are low, we have found, in the Meath Hospital, the most striking advantage from free blistering on the chest, and have never seen any unpleasant result. So, also, where pneumonia occurs in the course of a typhoid fever, the application of a blister, after depletory measures have been used, or where the skin is cool and the powers of re-action are slight, has been frequently successful in ameliorating or removing the disease. Our experience in the Meath Hospital leads us to the conclusion that, as far as the utility of blisters in fever is concerned, we may use them for the relief of the secondary inflammations which occur, with great benefit; always, however, acting on the principles which we have maintained in this article. [See the article Counter-Irritation for much information on this subject.]

William Stokes.

DERIVATIVES. See Derivation.

DIABETES.—Some of the earlier writers on medicine have given different names to the disease which forms the subject of the present article. Thus it has been styled *diarrhœa urinosa, hydrops ad matulam, hyderus, dipsacus, morbus sitibundus, fluxus urinæ, nimia urinæ profusio, polyuria.*

Owing to the excessive secretion and frequent evacuation of urine in this affection, it has also been named *diabetes*, from the Greek word διαβαίνω, which signifies to pass through: and from the circumstance of the urine having generally a smell of honey, and a sweetish taste, the adjective *mellitus* has been employed to denote this character. M. Renauldin, in an able article on diabetes in the Dictionnaire des Sciences Médicales, and afterwards Dr. Prout, insist upon defining diabetes to be "a disease in which a saccharine state of the urine is the characteristic symptom," although the etymological import of the word extends to any affection accompanied with an immoderate discharge of the urinary secretion. It is not the best logic, however, to found a definition upon an hypothesis; and as there are several instances on record of patients dying under all the symptoms of diabetes, yet without the slightest indication of sugar in the urine, we cannot fairly dispose of these by assuming its presence in the latent state; for it may be latent in the most incidental case of hysterical enuresis, and then how could Drs. Renauldin and Prout refuse the name of diabetes to this fortuitous symptom? We make no unfair extension of their hypothesis; and to speak truth, chemists have as yet discovered no good test of either sugar or urea when in small quantities, nor, were they perfect, ought medical men to take their results as defining disease. Diabetes, like every other malady, must not be defined by symptom *a* or symptom *b*, but by the aggregate and concatenation of the leading symptoms. Of these, immoderate excretion of urine and cachectic emaciation seem much more characteristic than sweetness, however general, and which it must be allowed is at times undistinguishable. All the modes of analysis hitherto devised for indicating the vegetable and animal oxides are extremely imperfect, especially when these are intermingled with other oxides; and the most delicate of them seem to consist, not in demonstrating the presence of these oxides themselves, but in generating new bodies, which are supposed to result from the re-union of the primary elements into which the former had been supposed to be reduced by their operation. In every genuine case of diabetes, however, Dr. Prout contends that a careful analysis of the urine will detect more or less saccharine matter, even when the sensible qualities of this fluid fail to point out the least saccharine impregnation; for, as Dr. Watt has observed, sugar may be present, but so covered with other substances that it cannot be at all detected by the taste.

Hippocrates seems to have been altogether ignorant of this affection, for we find no allusion to it in any of his writings; but Celsus, Galen, Aretæus, and Alexander Trallianus, have left us histories of diabetes. The description of it given by Aretæus is particularly clear and minute. These writers, however, looked upon the disease simply as an increased flow of urine, and as proceeding from renal irritation. Galen thought that this affection bore the same relation to the kidneys and bladder as the lientary does to the stomach and intestines. Aretæus considered it a colliquation of the flesh and limbs into urine. He has observed, "that it has the usual urinary course, namely, the kidneys and bladder, for the patients never cease voiding their urine, but as from the openings of the water-ducts, the stream is perpetual." Trallianus adopted much the same view of the complaint. No further light seems to have been thrown upon the nature of diabetes until the time of Willis, who first pointed out the saccharine taste of diabetic urine. "The subjects of this affection," that able writer has remarked, "pass more urine than the whole quantity of fluids taken into the body; they have besides a constant thirst, and a slow kind of hectic fever always on them. It is very far from true, as some authors affirm, of the drink being again discharged with little or no alteration, for the urine in all that I have seen, (and I believe it will universally be the case,) differed not only from their drink, and from every other fluid in the animal body, but was like as if it had been mixed with honey or with sugar, and had a wonderfully sweet taste." Willis has ably investigated the principal phenomena of the complaint, and endeavoured to point out its seat; but he confesses his ignorance of its causes and true nature. He has enumerated a variety of remedies adapted to the removal of the disease, but he admits the difficulty of ascertaining what are the true purposes which ought to be kept in view in its cure. At the commencement of the diabetic tendency, he found a cure by no means difficult; but in the advanced stage of the disease, such a result very seldom occurred. This he supposed was owing to the crasis of the blood being only a little loosened, and thus readily brought back again into its former state; but when so much dissolved as to have most of its parts separated from each other, it could seldom, if ever, be restored. The treatise of Willis upon diabetes has been translated by Dr. Latham, and published in his "Facts and Opinions" concerning that affection.

Sydenham, who lived for several years after Willis, and was cotemporary with him, has not alluded to the sweetness of the urine in diabetes, though he has left an extremely accurate description of its causes and the indications of its cure. We shall not attempt to account for this silence of Sydenham, by supposing, with Dr. Latham, that it arose from any other cause than mere inadvertency. Experiment was then but a new branch of science; and the practice of tasting the urine of a diabetic patient was probably first adopted by Willis, of all men, from the beginning of time; nor would the practical mind of Sydenham consider the announcement of more importance than if he had been told that the urine of hydrophobia was bitter; for what, in his time, was to be learnt from either? After Sydenham, we meet with notices of this affection in the writings of Cullen and Heberden; and since their time many attempts have been made to elucidate its real nature, and to establish a successful mode of cure. Dr. Rollo, however, strongly roused the attention of the profession to the subject by the publication and extended circulation of Captain Meredith's case, in which he proposed a new and important plan of treatment. To that author every praise is due for having enabled us to form more correct notions of the nature and cure of this complaint. The names of Cruikshank, Girdlestone, Fothergill, Dobson, Latham, Baillie, Lubbock, Bostock, Wollaston, Warren, Henry, Bardsley, Watt, Satterley, Prout, and Marsh, [Christison, M'Gregor, Bouchardat, Dezeimĕris, R. Willis,] may be mentioned as those of valuable contributors to the general fund of information which we now possess concerning this formidable malady.

It has been supposed that diabetes is a disease of more common occurrence at the present time than formerly, because we meet with so few notices of the complaint in the writings of authors from Willis to Rollo, compared with the numerous authentic records of diabetic cases since the valuable publication of the latter physician. The fact seems to be that the disease is now better understood, and its symptoms are more generally known, so that not a few cases which would formerly have been classed under the head of phthisis or tabes, are now ascertained to be genuine examples of diabetes. Dr. Storer, of Nottingham, states, in a letter to Dr. Rollo, that he had not seen a single instance of diabetes during sixteen years in which he had the case of an infirmary, containing upon an annual average fifty-two in-patients, and three hundred out-patients. In the Manchester Infirmary, diabetic patients not unfrequently present themselves for admission, and it generally falls to the lot of each of the medical officers of that institution to receive several cases under his care during the year. On inquiry, we have found that the same holds true with other extensive public hospitals. In private practice, too, instances of this disease are by no means uncommon; for we believe there are few medical men who have a fair share of professional employment, to whom cases of diabetes have not somewhat frequently occurred. Diabetes occurs in early as well as in advanced life. Heberden erroneously supposed that it exclusively attacked the aged and infirm. We have witnessed two instances of this disease in children under six years of age; and Dr. Venables has also recorded several marked cases of infantile diabetes. A very distinct example connected with the process of dentition, and in which the urine was sweet, is related by Morton. More than half of the cases seen by Dr. Watt,—and he believed the same observation would hold with regard to all that have been published,—occurred between the ages of thirty and forty-five; and of the other half a greater number were below the former of these ages than above the latter. "Of the whole," he says, "the best marked and most rapid in their progress have occurred in the very prime of life, and when the constitution was supposed to be in its full vigour. There is, perhaps, no period of life completely secure from the disease, though few instances have been recorded under the age of puberty. I have met with one instance in a boy of three years of age. It was most distinctly marked; the urine amounted to six or seven pints daily; the voracious appetite, urgent thirst, and arid skin were very remarkable. He had also phymosis, and afterwards suppression of urine. The disease terminated in a fatal dropsy."

This disease not unfrequently makes its approach insidiously; and it unfortunately happens that the first symptoms are often disregarded, and the complaint is allowed to advance for some time uncontrolled by medicine. The increased flow of urine is merely regarded as the necessary effect of the thirst, and the discovery of the saccharine condition of this fluid is also mostly accidental; but when hectic, emaciation, and debility have supervened, a more strict inquiry into the symptoms is generally instituted, and the real nature of the complaint becomes fully ascertained. The almost constant desire to make water, and the insatiable thirst, particularly during the night, are two most distressing symptoms; the patient being obliged to be supplied with a large quantity of fluid near his bed-side, and having to rise six or seven times or oftener to evacuate the bladder. The urine has a slight straw colour, and sweetish taste, and yields on evaporation a considerable quantity of saccharine extract. The amount of this secretion passed during the twenty-four hours is sometimes very considerable. It has exceeded, in more than one instance, seventy pounds. In the case of Smith, detailed in the writer's "*Hospital Facts and Observations*," thirty-six pints of urine were voided in the course of twenty-four hours; and in that of Johnson, thirty-two pints. The discharge, generally speaking, is less than the liquid ingesta; but it has been found in one or two cases, that the liquid egesta have considerably exceeded the whole amount both of the solid and liquid ingesta. This fact, though denied by some writers, has been satisfactorily established by Dr. Bardsley, who has shown that the excess of the former cannot be accounted for solely on the supposition of its being derived from a general wasting and diminution of the solid and fluid parts of the system; for in two or three instances during the period in which the register clearly pointed out almost a regular daily excess in the amount of the urine compared with that of the liquids and solids taken, the patients had gained an accession to their weight of many pounds. "To what law or process of the animal economy," the author just named observes, "is the supply of this superabundant quantity of urine to be attributed? Is it derived from cuticular or pulmonary absorption, or from a colliquation of the humours of the body? Each of these modes has been insisted on by different writers." We receive the fact without framing any hypothesis to account for it. The researches of modern physiologists, particularly those of Klapp and Dangerfield, do however render it extremely probable that this superabundant quantity of fluid is absorbed by the lungs from the moisture of the atmosphere. Numerous observations demonstrate that almost every kind of matter in the state of fluid or vapour, introduced into the cells of the lungs, is rapidly absorbed from thence into the circulation, and, generally speaking, presents itself at the kidneys; thus the oil of turpentine manifests itself in the urine within a few minutes; and the amount of these facts goes to prove that there is a free and rapid absorption always taking place on the surface of the lungs. On the other hand absorption through the cuticle, if it exists at all, cannot be demonstrated; while it is admitted by almost every one, that nine-tenths of the copious exhalation of the pulmonary surface, which, according to proportion, must at least be ten times as great as that by the skin, or twenty pounds daily, is constantly in the act of being re-absorbed by the pulmonary surface: and since the avidity of the absorbents is known to be greatly augmented, as in dropsy, by an increased diuresis, while the pulmonary exhalation must be proportionally diminished, it is easy to conceive that the absorption of the fluid excreted from the bronchi will be considerably increased, and thus augment the quantity of fluid egesta above the ingesta. There will, moreover, be absorption of part of the residual air in the lungs, and this will again supply itself from the now moister air brought in from the atmosphere by inspiration, to what extent it is not easy to compute; nor can we reasonably expect that any such computation will correspond very exactly with the weights of the ingesta and body at different times, the means of taking which are often much more fallacious than is generally believed.

The mouth is mostly dry and parched, the taste is perverted, and the secretion of saliva altered. [Mr. M'Gregor found that it fermented briskly in a diabetic patient, when yeast was added to it, and complaints are often made of a constant sweet mawkish taste in the mouth, and a feeling as if the teeth were set on edge.] A tough viscid phlegm occupies the fauces; the tongue has a brownish fur on its centre, with florid edges; the gums are soft, spongy, and bleed on the slightest pressure of the tongue against them, being mostly ulcerated about the roots of the teeth; the appetite is usually keen, and sometimes ravenous; uneasiness about the stomach and bowels is experienced, chiefly after eating, and the contents of the former are not unfrequently discharged in an acid and undigested state; the skin is rough, dry, and unperspirable; the bowels are generally costive; there is frequent pain and a constant sense of aching and weakness across the region of the kidneys, particularly on the least exertion; itching and excoriation, with phymosis of the prepuce, occurs in males, and an uneasiness about the meatus urinarius in females; the semen is discharged involuntarily, chiefly after voiding urine; and there is a total loss of the sexual propensities. Headach, impaired hearing, giddiness, and indistinct vision, are mostly present. When these symptoms continue only for a short time, they are followed by serious disturbance in the general health, such as extreme debility, languor, and great emaciation. The pulse, which is at first quicker than natural, becomes slow and feeble. The legs and ankles swell; and a tickling cough, with shooting pains in the chest, mostly harasses the unfortunate patient in the last stage of his disorder. The mind is extremely peevish, irritable, and somewhat suspicious; the spirits are low and depressed.

By attention to the above symptoms, it is not, we conceive, difficult to distinguish diabetes from every other disease. There may be a preternatural discharge of urine in other affections; but *in this only* is a saccharine condition of that secretion present. Most of the more severe symptoms of this disease are attributable to the immense amount of solid matter which is constantly draining off from the body; and indeed some diabetic patients seem to sink merely from the debility occasioned by the continued secretion of an unnatural quantity of urine containing so large a proportion of animal extractive matter. The appetite, though voracious, is inadequate to the supply of nourishment sufficient to balance the immense and rapid waste which is daily taking place. "The loss of so much matter," Dr. Elliotson observes, "from the system, sufficiently explains the hunger, the feeling of emptiness and sinking in the stomach, the emaciation, debility, anaphrodisia, coldness of the legs, pain both of them and of the loins, the depression of spirits, &c. without attributing the disease to the stomach or the kidneys exclusively. The excessive escape of fluid, or when this does not take place, the feverishness, equally explains the thirst and dryness of the skin."

It will be shown, when we come to the consideration of the pathology of diabetes, that it is mostly complicated with disease in some important organs. Dr. Willan observed that he never met with a confirmed case of this disease in which there was not some considerable disorder of the constitution, or a defect in some organ essential to life. Our experience leads us to hold this remark as not far removed from truth; although it may be said that the constitutional affections are more frequently the effects of the progress of diabetes, than the concomitants of its commencement. Pulmonic affections, we know, not unfrequently precede or accompany diabetes. Dr. Bardsley remarks that he scarcely recollects an instance of the disease where a slight affection of the chest did not more or less prevail. In several instances, too, on record, a connection between phthisis pulmonalis and diabetes is strikingly marked. The phthisical symptoms existing previously to the attack of the latter disorder are often suspended by its influence; but on the partial removal of the diabetic complaint, the tubercles pass rapidly through their several stages, and the patient's sufferings are terminated by death. A similar suspension of the progress of disease in the lungs is sometimes noticed in females who become pregnant whilst labouring under the symptoms of confirmed phthisis. The cough, expectoration, and hectic fever, almost entirely disappear, pregnancy advances, and labour ensues; when in the course of a few weeks (sometimes days) the pulmonary symptoms return with aggravated severity, the strength rapidly declines, and life is soon extinct. In the more confirmed cases of this disease which have fallen under our notice, there has been generally present a teazing tickling cough, sometimes attended with purulent expectoration, and mostly with dyspnœa, and shooting pains in the chest.

The most common exciting causes have been, according to our experience, frequent exposure of the body to sudden alternations of heat and cold, and an indulgence in copious draughts of cold fluid when the system has been over-heated by labour or exercise. In twelve cases that have come under our observation, the patients have attributed their ailment to one of these causes; hence, we have observed this affection chiefly amongst that class of artisans whose occupations expose them to sudden changes of temperature, or who reside in damp and low situations. The intemperate use of spirituous liquors, poor living, and distress of mind, not unfrequently operate, too, in the production of this disorder. It is a curious analogous fact, that dogs and rabbits fed upon rye-meal, or on decoctions of wheaten flour, have a species of diabetes produced: as has been ascertained by the experiments of Dr. Krimer of Hallé. The secretion of urine becomes much increased: the urea and uric acid almost or altogether disappear; the animal becomes emaciated; and in place of sugar, the urine is found loaded with albumen and mucus. The origin of the complaint has been traced by some patients to sleeping out the whole of the night in the open air, in a state of intoxication. The subjects of this disease have been mostly liable to profuse sweating upon any ordinary exertion, and at such times have been accustomed to abate thirst by drinking freely of cold liquids, or by eating immoderately of acid fruits, thus suddenly checking perspiration. The state of the mind seems to have a more intimate connection with this affection than has been generally supposed. In several cases on record, mental anxiety and distress have been assigned as its chief cause. Indeed, a temporary diabetes insipidus is a very ordinary effect of such a state, and the despondency of mind throughout the disease is distinctly alluded to by Aretæus, and by many other eminent writers.

We have not observed the characteristic odour, compared to that of hay, from the persons of diabetic patients, to which Dr. Latham has particularly alluded. It has been supposed that the phymosis before noticed as a symptom of diabetes, proceeds from the extreme sensibility of the urethra, which subjects it to the general irritation of the system so frequently present in the complaint, and thus renders it morbidly sensible to the stimulus of the urinous fluid.

With respect to the emaciation, it may be remarked that Dr. Lubbock considered it a leading circumstance in this affection: for in his experience it came on slowly, the subject of it not perceiving much deviation from health. "I have at this time," he observes, "two patients who, excepting a slight and very gradual wasting of the body, some increase of thirst, with occasional uneasy sensations about the stomach, to which may be added, feebleness of sight at times, and an habitual tendency to phymosis, possess that degree of apparent health and strength that would mislead a common observer." He conceived that the emaciation claimed the first attention of the physician; as without the removal of this symptom, neither the reduction of the urine, the alteration of its quality, nor the appearance of considerable remaining muscular power, could prove that the disease had yielded to any curative process.

Diabetes frequently occurs in the scrofulous habit, but is not confined to it alone. Some authors are of opinion that the disease may be hereditary; thus Dr. Prout observes, he cannot doubt but that a predisposition or tendency to this affection exists in some families, as he has witnessed four distinct instances of such a circumstance. The first was that of a young man whose mother and uncle had died of the disease; the second was that of a lady about fifty years of age, whose brother or sister had sunk under the complaint; the third was that of a girl about ten years of age, whose father two or three years before had died of the same affection; the fourth instance was that of a gentleman, aged fifty-four, who died of this affection, and whose father had laboured under the same disease for several years. Dr. Storer has noticed the occurrence of three cases of diabetes in one family, in the persons of a brother, sister, and her daughter. The father of the two elder died of that affection. In another instance, related by Mr. Leigh Thomas, three brothers in one family laboured under diabetes. Morton has also alluded to the hereditary nature of the disease. We believe that a tendency to it is occasionally inherited; but further experience and a more extended inquiry on this point are necessary, before diabetes can be correctly arranged like scrofula, phthisis, mania, and apoplexy, under the head of *family* diseases; for in not a few instances no hereditary origin can be traced. Yet, it must be observed, that even of these diseases, no two have exactly the same hereditary influence, nor are any two of them modified exactly in the same degree by circumstances;

while all of them are seen to spring up every day in cases where no hereditary taint can be suspected; so that, if a comparatively rare disease like diabetes has been found by Dr. Prout hereditary in four times out of twenty, it seems fair to admit, that, as in the case of a great many other diseases, its supervention is often greatly favoured, if not determined, by hereditary conformation; and little more can be said even of scrofula or mania.

Various opinions have been formed concerning the *proximate cause* of diabetes. Thus some authors of eminence, like Mead, have supposed that it depends on a "morbid state of the liver and bile;" some, as Dobson, Home, Cullen, and Rollo, believed that it proceeds from a defect in the assimilatory organs; whilst others, as Dupuytren and Thenard, have attributed the principal phenomena of the disease to a "morbid action of the kidneys." Dr. Baillie also thought it probable that diabetes was owing to a deranged action of the secretory structure of the kidneys, by which the blood there is disposed to new combinations; and that the effect of these combinations was the production of a saccharine matter. He at the same time imagined that the chyle might be so imperfectly formed as to cause the blood to be more readily changed into a saccharine substance by the action of the kidneys. The ingenious author of the Zoonomia conceived that diabetes was produced by a retrograde motion of the absorbent vessels, owing to which chyle passed from the lacteals into the lymphatics of the kidneys or bladder. Cawley thought that in this disease the tubuli uriniferi were enlarged or relaxed, by which the chyle escaped into the urine. Willis concluded that diabetes depended upon a dyscrasy or intemperament of the blood, resulting from a morbid action of the assimilating powers. "Thus," he observes, "diabetes is rather and more immediately an affection of the blood than of the kidneys, and it thence has its origin, inasmuch as the mass of blood becomes, as it were, melted down, and is too copiously dissolved into a state of serosity, which indeed is very manifest from the quantity of urine so immensely increased, which cannot arise from any other cause than from this solution and waste of the blood: whence also the blood, which is left in the body, the serum being thus copiously abstracted from it, becomes much thicker and more apt to coagulate, as we may infer from the quick and laborious pulse; for on that account the heart acts with more rapidity, that the blood, which it thus agitates more than is usual, may be preserved from coagulating." The two hypotheses, however, which refer the seat of the disease to a morbid action of the stomach, and a morbid condition of the kidneys, have been most generally adopted. "Were I to give a theory," says Dr. Home, "to explain the nature and symptoms of this wonderful disease, I would say that it arises from a defect of the animal or assimilatory process, by which the aliment is converted into the nature of our body."

Dr. Home considered the excess or defect of this process as the source of many disorders. Rollo, too, observes that the immediate cause of diabetes mellitus is a morbid condition of the stomach, forming or evolving from vegetable substances saccharine matter, which is quickly separated as a foreign body by the kidneys. "But, to be more particular," he continues, "we allege that this disease consists in an increased morbid action of the stomach, with too great a secretion, and an alteration in the quality of the gastric fluid, producing saccharine matter by a decomposition of the vegetable substances taken in with the food, which remains unchanged." It has been urged, and with reason, as a very serious objection to the theory of Dr. Rollo, that no sugar has been detected in the blood of diabetic patients; a fact which we shall shortly show to be established by the interesting experiments of Wollaston, Marcet, Nicholas, Gueudeville, Thénard, Bostock, Vauquelin, Segalas, and other able chemists.

In several instances of the disease which have come under our own examination, there certainly has been ample evidence of preceding stomach derangement; but admitting that the stomach is generally in a state of morbid activity, as may be inferred from the increased and almost insatiable appetite which accompanies the disease, still we are ignorant of the particular condition of the primæ viæ which leads them to favour the extraction of sugar. Dr. Henry thinks that the theory must be modified by assuming that the blood which reaches the kidneys contains the elements of sugar, and is deficient in those of urea. He supposes, however, that it is necessary to a just pathology of the disease that some morbid condition of the kidneys should be admitted, though of a kind which has not yet been explained by anatomical investigation.

Dr. Mason Good conceived that a morbid and highly irritable state of the kidneys was sufficient to account for every other derangement that marks the progress of the disease. He saw no necessity for supposing an idiopathic affection of any other part, whether the stomach or the nerves, the digestive or the assimilating powers; but decides, from the attention which he has paid to the nature of diabetes, both in theory and practice, that the whole of its phenomena may be traced to renal mischief, and consequently that it is a far less complicated affection than has hitherto been supposed. That the kidneys are frequently in a state of irritation is evident from the pain, heat, and weakness, experienced in those organs, and the augmented urinary secretion.

Dr. Lubbock seems to have noticed the coincidence of the parched and dry skin with the saccharine quality of the urine, from which he was induced to believe that in this affection the want of perspiration or excretion from the surface is connected with sweetness of the urinary fluid; and this belief was supported by an examination of the nature of the perspirable fluids, and of the component parts of saccharine matter. On this view he has formed a theory of diabetes. "It has been proved," he observes, "that sugar is, for the most part, composed of carbon, oxygen, and hydrogen, united in a certain ratio; and it appears, by the experiments of Cruikshank and Abernethy, that, besides the occasional aqueous fluid discharged daily from the surface of the body, about three gallons of carbonic acid are also lost to the system by the perspirable matter. Now supposing, as happens in diabetes, this perspirable excretion, or carbonic acid, is suppressed and retained in the system, it is probable that the carbon and oxygen of the acid so retained, by entering into a due combination with some portion of the hydrogen of the animal body, may tend to the production of the saccharine matter of the urine; and as the carbonic acid is the general product of the vegetable world, it would follow that its retention in the animal body may produce the phenomena of the defective animalization, characterising diabetes as exhibited in the formation of sugar."

Dr. Latham has broached a very fanciful hypothesis concerning the proximate cause of diabetes, founded chiefly on the dyscrasy of Willis, and the selecting power of the kidney. As it is impossible to condense it, we shall be satisfied with merely mentioning that it is quite as untenable as some of its ancient predecessors. Dr. Ferriar has also given a very vague opinion in explanation of the phenomena of this disease. He supposes that if the extreme vessels should from any cause take on a morbid action, and, instead of supplying nutritious matter, should form a substance which cannot be applied to renew the waste of the system, the diseased secretion must either accumulate in the intermediate passages of the circulation, where it would produce hectic fever, (by absorption,) and subsequently death; or it must be carried off by some of the emunctories, to which its stimulus must cause an increased determination of fluids. This he conceives to be precisely the case in diabetes. He afterwards refers the secretion of saccharine matter in the kidneys to metastasis, and supposes it to arrive there by the circuit of anastomosing branches.

In a reply to some strictures of the reviewer in the Medical and Physical Journal, on a case of diabetes related in the sixth volume of the Edinburgh Medical and Surgical Journal, the editor observes that the discharge in diabetes may be a diversion of a profuse secretion from the skin to the kidneys; that besides being morbidly profuse, it is, like other secretions, susceptible of a change, and may become stimulating even to the skin itself, and consequently much more so to the kidney, where it then must certainly act as a foreign body exciting the organ to extraordinary action; and that in the enlarged and excited state of the vessels of the kidney, time is not allowed for the secretion of urine to be perfect, and that chyle may pass off with it, or it may be called the urine of digestion or of the chyle, which in the healthy state is passed two or three hours after a meal, and cannot be considered a natural secretion. M. Dezéimeris supposes that the proximate cause or essence of diabetes consists in irritation of the kidneys; that this irritation is rarely primitive, being mostly the result of chronic gastritis. In the course of the latter affection there is extreme thirst; the patient drinks freely, and the urine is in proportion: this state is prolonged; the activity of the kidneys increases every day at the expense of that of the other excretory organs; they remove from the body those fluids which require constant renewal, and thus again contribute to augment the thirst.

Such are only a few of the hypotheses which have been framed to explain the nature of diabetes; but they are sufficiently numerous to show how little is really known respecting it. One great cause of this diversity of opinion is, as we shall hereafter show, the defective aid afforded by pathological investigation. "Pathological anatomy," as the late celebrated Laennec justly remarked, "is incontestibly the surest guide of the physician, either in the recognition of maladies, or in the cure of those which are susceptible of cure." We have no theory of our own to propose; but from all the attention which we have been able to pay to the subject, and from what we have seen of the disease itself, it appears to us proper to admit that the natural and healthy action of *both the stomach and kidneys* is materially disturbed; the former perhaps primarily, and the latter secondarily; and that the *dry and unperspirable condition of the skin* is much more intimately connected with its production than is generally supposed: thus diabetes is an affection not proceeding from a morbid action of one particular part, but of several important organs. This statement is sanctioned by facts, and seems to derive confirmation from the symptoms, the remote causes, the effects, and analogy with other diseases. We have used the word *perhaps* in the above allusion to the primary derangement of the stomach, because in several diabetic cases on record the increased secretion of urine preceded every other symptom. So constant is the sympathy between the kidneys and the stomach, that Sydenham himself has declared there is no other mean of distinguishing between nephritis and lumbago than the expression of this sympathy in the former case by vomiting. It is possible that increased action of the kidney may very early, though not primarily, call the stomach into sympathy. In a communication from our friend Dr. Milligan of Edinburgh, he remarks that the famous Peter Petit asks, in his Commentary upon Aretæus, if the excess of sugar is furnished by an error of the digestive process, why does it not pass off by the bowels, the lungs, or the skin, as well as by the kidney? "But this very profound and philosophical question is very easily answered by the practical observation, that we know, as a matter of experience, that any excess of fluid introduced into the circulation does not readily pass off by the skin, lungs, or bowels, but seems naturally and designedly in almost every instance to be carried away by the route of the kidneys and urinary passages; and that, therefore, we have a right to expect that it will be so here. But it does not follow from this that the *first* profusion of urine in diabetes is saccharine, nor yet that the initial steps of the malady are to be traced to errors in the action of the stomach or the skin: nay, so great is the number of persons who at all times labour under disease of the two latter organs, that on diabetes commencing we should require very strong proofs that some aggravation of the morbid condition of these parts, unconnected with any suddenly interposed cause, took place at the time, before we admitted that they were instrumental in producing diabetes."

[For some other views on the nature of Diabetes, see page 617.]

We must next allude to the *prognosis* to be generally formed in this malady. It has been satisfactorily proved that a saccharine condition of the urine may exist during several years without the general health being materially affected, or the powers of the stomach much impaired. Diabetic patients, whose mode of living has been on the whole temperate, have been known, in not a few instances, to reach advanced age. It is in those cases, chiefly, where the constitution has been previously injured by long-continued and frequent irregularities that the disease under consideration proves rapidly fatal. Whilst the digestive organs continue to perform their functions with tolerable vigour, the supply of nutritious matter will be found nearly adequate to balance the waste which is daily taking place from the increased quantity of the urinary secretion. We have at this time two diabetic patients, who, excepting some increase of thirst and urinary discharge, and occasional disturbance of the digestive organs, enjoy a fair share of apparent health and strength, and are fully equal to the various exertions that devolve upon them in the ordinary intercourse of life. The disease, however, ought to be viewed with much concern, for it is too apt to pursue its fatal progress in defiance of all the resources of our art. It is difficult to establish a perfect cure when the characteristic symptoms of the affection have been once fairly developed. We find that even Aretæus alluded to its fatal nature. He has remarked, "that the disease is chronic, and generated by length of time; but short is the life of man when its establishment is fully completed." The perfect recovery of the patient depends upon the removal, not merely of one, but of the whole of the symptoms; for one may be relieved by the aggravation of another. Though there may be a considerable reduction in the quantity of the urine, still if there be no alteration in its quality, and the saccharine impregnation continues, the disease cannot with propriety be said to have yielded to any curative process. It is by close attention to, and an early discovery of the premonitory symptoms that we must hope to prevent a fatal termination. The disease unquestionably may be controlled at its commencement by the employment of the means hereafter to be pointed out; but it unfortunately happens that the malady has in most instances made considerable progress before the patient's attention has been called to its real nature. Rollo, Beddoes, Cleghorn, Watt, Bardsley, and others have related cases of diabetes in which a cure has been effected; but this happy result is by no means of common occurrence. When the disease is complicated with phthisis, scirrhus, or other organic mischief in any important organ, all hope at once disappears.

With regard to the perfect cure of diabetes, it is certainly necessary to speak with much caution; for, like some other formidable diseases, it is for the most part only capable of being relieved, and not of being effectually removed. "Within the last six or seven years," says Dr. Prout, "nearly twenty cases of diabetes have fallen under my observation; and among these, I have never but in *one* instance, and in that *for a very short time only*, seen the urine of a diabetic patient rendered quite natural." Dr. Lubbock, too, never saw this disease yield to any curative measures; the emaciation continued to increase more and more, until after a lingering and protracted state of suffering, the unhappy subjects of it at last gradually sunk. Of twenty-nine diabetic patients who have been under our care, sixteen have eventually died, strongly evincing the fatality of the disease; eight out of the remaining thirteen have perfectly recovered; and of the other five we have received no account. The chances of restoration to health are frequently diminished by the irregularities of the patients themselves, in deviating from the prescribed modes of treatment, notwithstanding the strongest promises on their part to comply strictly with the wishes of the practitioner.

Previously to enumerating the *morbid changes* which have been observed after death in diabetes, it may be well to inquire what light has been thrown upon the pathology of this disease by chemical analysis of the urine and blood of diabetic patients.

Sensible Properties and Chemical Analysis of the Urine in Diabetes Mellitus.— Several distinguished chemists (amongst whom may be mentioned the highly respectable names of Cruikshank, Fourcroy, Nicolas and Gueudeville, Thénard, Vauquelin and Ségalas, Dalton, Bostock, Henry, and Prout) have sedulously occupied themselves in investigating the properties of diabetic urine, and have performed a variety of interesting experiments, with the view of determining the precise nature of that morbid secretion. The sweet taste of diabetic urine seems, as before observed, to have been first distinctly pointed out by our countryman Dr. Willis. Since his time, the existence of sugar in the fluid has been satisfactorily determined. It is worthy of remark, however, that the saccharine impregnation of diabetic urine is not at all times discoverable by the taste; for that secretion has been found to vary at different intervals during the twenty-four hours. In the case of a young lady, related by Mr. Shirreff, the urine voided at one o'clock was free from sweetness and perfectly insipid; some time after it appeared natural, but two hours after dinner was sweet, and in the evening again perfectly natural. The urine in this disease has, it has been already said, a pale-straw colour. It is mostly clear when first voided, but on standing some time in the vessel, not unfrequently deposits a white flaky precipitate. Its smell at first strongly resembles that of new hay, but in the course of a short time a faintish acid odour may be perceived. It has been stated that the temperature of diabetic urine, when recently voided, is lower than that of the healthy secretion; but this is a point which we have examined with much care, and we have found that no marked difference exists between them. An important circumstance connected with the consideration of the peculiar character of diabetic urine is its *specific gravity*. The profession is under obligations to Dr. Henry for having satisfactorily shown that the specific gravity of the urine in diabetes mellitus is higher than in healthy urine; a circumstance which had been overlooked by some of the most eminent writers on the chemical history of that disease. In ten cases of diabetes where he had an opportunity of determining this property, it never fell short of 1028 nor exceeded 1040;

1000 parts of water at 60° Fahrenheit being taken as the standard; whereas in healthy urine he never found the specific gravity, under any circumstances, to exceed 1020. Dr. Henry has recently informed us that subsequent trials of the specific gravity of the first morning's urine of healthy persons lead him to believe that this is understated, though perhaps a fair average for the whole day. Dr. Henry considers the specific gravity as a most useful test of the existence of diabetes in doubtful cases, and, when taken along with the actual quantity discharged, as furnishing a tolerably correct idea of the degree of morbid action. "It may be objected, perhaps, (he observes,) to the employment of this test, that it requires more familiarity with the method of taking specific gravities than falls to the lot of the greater part of medical practitioners. By means, however, of an hydrometer, which is well known to practical chemists, and which may be readily procured at a small expense, the specific gravity of the urine may be taken in a few moments, and with the greatest accuracy, by a person wholly unaccustomed to experiments of this kind." Deeming it desirable to establish a connection between the quantity of extractive matter and the more certain character of specific gravity, Dr. Henry engaged in a series of carefully-conducted experiments, and from them constructed the following *table*, which exhibits at one view the quantity of solid matter in diabetic urine of different specific gravities between 1050 and 1020. The scale may be extended, however, by the rule of proportion, to any case in which the urine may be found to have a specific gravity above the former or below the latter of those two numbers. In the experiments which furnished the above data of the table, the urine was evaporated by a steam heat till it ceased to lose weight, and till it left an extract which became quite solid in cooling.

Specific gravity of urine compared with 1000 parts of water at 60°.	Quantity of solid extract in a wine pint, in grains and tenths	Quantity of solid extract in a wine pint, in			
		oz.	qr.	scr.	gr.
1020	382.4	0	6	1	2
1021	401.6	0	6	2	1
1022	420.8	0	7	0	0
1023	440.	0	7	1	0
1024	459.2	0	7	1	19
1025	478.4	0	7	2	18
1026	497.6	1	0	0	17
1027	516.8	1	0	1	16
1028	536.	1	0	2	16
1029	555.2	1	1	0	15
1030	574.4	1	1	1	14
1031	593.6	1	1	2	13
1032	612.8	1	2	0	12
1033	632.	1	2	1	12
1034	651.2	1	2	2	11
1035	670.4	1	3	0	10
1036	689.6	1	3	1	9
1037	708.8	1	3	2	8
1038	728.	1	4	0	8
1039	747.2	1	4	1	7
1040	766.4	1	4	2	6
1042	804.8	1	5	1	4
1044	843.2	1	6	0	3
1046	881.6	1	6	2	1
1048	920.	1	7	1	0
1050	958.4	1	7	2	18

By referring to this table, we can readily ascertain the quantity of solid matter voided by a diabetic patient in a given time. Thus, as Dr. Prout has noticed, suppose ten pints are passed in twenty-four hours, of the average specific gravity 1040, it is evident that this will contain $\overline{10\times 1\,..\,4\,..\,2\,..\,6} = 15\,..\,7\,..\,2$, or upwards of a pound and a quarter of solid extract.

The quantity of extractive matter obtained from diabetic urine is liable to considerable variation: but it is for the most part in proportion to the violence and severity of the disease, especially when the patient is not confined to any rules of diet. It has amounted in a few instances to more than two ounces from one pint (wine measure) of the fluid; but the medium quantity in even very aggravated cases of diabetes mellitus may be fairly estimated at not more than ten drachms of solid extract. The specific gravity, too, sometimes changes in a very remarkable manner. In the case of a patient lately under our care, it was reduced in the course of two days from 1033 to 1022, and very shortly afterwards it reached 1042. In another instance, alluded to by Dr. Prout, the specific gravity was reduced in about sixty hours after the patient had commenced with the use of opium, from 1038 to 1.1074. The saccharine matter had apparently disappeared, and was afterwards superseded by urea, the quantity of which had become excessive.

The able author just mentioned has shown that an excess of urea frequently precedes the appearance of saccharine matter in the urine. "Now it is a remarkable fact," he adds, "that in diabetes, in proportion as the saccharine matter diminishes under the above plan, that of urea generally increases; and in such instances the presence of the former principle cannot only be no longer distinguished by the sensible properties of the urine, but scarcely be demonstrated by the utmost skill of the most experienced chemist, though the specific gravity of the urine may at the same time be nearly 1040." Sometimes sugar is wholly wanting in diabetic urine even when the urea has altogether disappeared. Dr. Young met with an instance of this kind. After evaporating the fluid in a gentle heat, a brown substance was dissolved in abundance in alcohol, and afforded a stiff extract, which contained the lactic acid with a little trace of lactate and muriate of ammonia, but consisted almost entirely of the animal extract which accompanied the lactates, was precipitated by tannin, and left after combustion a little muriate of soda, which showed a slight trace of uncombined alkali.

It has been matter of dispute whether urea is contained, in any proportion whatsoever, in diabetic urine. Whilst Cruikshank, Dalton, Fourcroy, Nicolas and Gueudeville, Thénard and Bostock contend for the non-existence of urea in the urine of patients labouring under diabetes, Henry and Prout maintain that, although the quantity of that substance be very much diminished, still it is never entirely absent. Dr. Bostock published a highly valuable paper on diabetes in the 6th volume of Memoirs of the Medical Society of London, in which he stated that he had procured nitrate of urea in abundance, along with oxalic acid, from the extract of diabetic urine. He was afterwards induced to repeat his experiments at the request of Dr. Bardsley, who sent to him several pure specimens of saccharine extract for examination, having himself failed in several instances to detect any urea in diabetic extracts. The result was, that Dr. Bostock found his former inference to be erroneous, and with a candour very honourable to himself, acknowledged that we have no evidence of the existence of urea in diabetic extract.

In the experiments of the seven first named chemists, the test employed to detect the presence of urea was the addition of nitric acid to the extract of urine dissolved in a small quantity of water. On treating extracts obtained by slow evaporation from healthy urine in this manner, they found that a copious precipitation of nitrate of urea always ensued; whereas in their trials with diabetic extract they seem to have failed to discover any traces of urea. Dr. Henry, however, has satisfactorily shown by several experiments conducted for the purpose, that the action of nitric acid on the urea may be prevented by its agency on the greater proportional mass of sugar. He has stated that urea cannot be made apparent by nitric acid in the extract from any mixture of diabetic and natural urine, when the former exceeds the latter in a greater proportion than that of six to one; or when the solid urea is less than one-twentieth of the weight of mixed extract. It is on the ammonia which comes over *early* in the distillation of diabetic urine, that Dr. Henry seems disposed chiefly to insist, as establishing the presence of urea, because there is no other animal substance which can give origin to the volatile alkali under such circumstances. "Another proof (Dr. Henry observes) of the existence of some portion of urea in diabetic urine, may, in many instances, be obtained by a careful observation of the phenomena attending its spontaneous decomposition. At a temperature exceeding 60° Fahrenheit, diabetic urine passes rapidly to the acetous state. But if the succession of changes be carefully watched, it will be found that there is a point at which, before it becomes acid, it exhibits, to sufficiently delicate tests, distinctly alkaline properties." "The deficiency of urea in diabetes," he adds, "may be stated as being very considerable. In those cases where I have attempted to estimate it, from the quantity of ammonia evolved by the destructive distillation of the urine, the urea has not appeared to exceed from 1-40th to 1-60th the quantity contained in an equal measure of concocted healthy urine. One specimen of diabetic extract, with which I was favoured by Dr. Bardsley, approached so near to perfect whiteness, that there appeared to me little reason to expect any evidence of its containing urea. Yet even in the product of the distillation of this extract, after being rectified with the addition of potash, ammonia was found. On distilling, also, a portion of the urine itself, the condensed liquor gave manifest traces of carbonate of ammonia. This urine, however, contained a far less proportion of urea than I had ever before ascertained; not exceeding, as nearly as I could estimate, 1-80th of the natural quantity. Making every allowance, then, on account of the increased flow of urine, it will appear that the quantity of urea discharged by persons labouring under diabetes, in any diurnal interval, falls considerably short of the quantity voided in a state of health." We have repeated these experiments with great care on an extensive scale, and are satisfied with their accuracy. Dr. Prout also considers the absence of urea as by no means characteristic of diabetes. He admits that in this, and some other affections of the urine, very little urea is sometimes present; but the same he shows to hold with respect to the other principles, many of which are deficient in such urine as well as urea. He never met with a specimen in which it was entirely absent. It may in fine be correctly stated that there exists a *deficiency*, though *not a total want of the urea*, in the urine discharged in well-marked cases of diabetes mellitus.

[It would appear, however, from the observations of Messrs. Christison, M'Gregor, and Bouchardat, that urea is generally contained in diabetic urine in larger relative proportion than in health, but that it is masked by the presence of sugar, and cannot be discovered by the addition of nitric acid, except by peculiar management.]

It may be proper to notice the effects produced by certain *re-agents*, and by *evaporation*, on diabetic and healthy urine, according to the experiments of MM. Nicolas and Gueudeville. 1. Tincture of turnsol added to diabetic urine received a reddish violet tinge; with healthy urine it assumed a deep red. 2. Nitrate of silver occasioned in diabetic urine a curdy precipitate, of which the colour, at first white, soon changed to violet, and the liquor became limpid with a slight tinge of yellow; it was altogether inodorous. With healthy urine the same re-agent afforded an abundant precipitate of a deeper violet colour, and the liquor preserved a yellowish red colour, and emitted a strong urinous odour. Each precipitate consisted of nitrate and phosphate of silver. 3. Lime-water produced a milkiness in diabetic urine, immediately rendering it turbid, and affording a faint ammoniacal odour. After some time a flocculent precipitate occurred, of which a part remained on the surface of the liquor, which became as limpid as water: this precipitate was phosphate of lime. The same test also rendered healthy urine opaque, and the precipitate was white and extremely buoyant; but the liquid preserved a fine lemon-colour; the precipitate, a phosphate of lime, was also more abundant by one-half. 4. Concentrated sulphuric acid added to diabetic urine afforded a beautiful rose-colour, occasioning at first a slight effervescence. The surface of the fluid became covered with a light froth, which remained for a long time, and there was scarcely any precipitate: the liquor was inodorous. At the instant of mixing sulphuric acid with healthy urine, the effervescence was scarcely perceptible and the foam was slight. The liquor assumed a reddish brown colour, and preserved the odour of urine: at the bottom of the vessel was observed a small quantity of a darkish red precipitate. Dr. Henry has mentioned to us that on adding nitric acid, moderately diluted, to diabetic urine, he has often observed a change of colour to a red, resembling that of a weak acidulated infusion of rose-leaves, and an immediate and very sensible increase of the saccharine odour. 5. Muriate of barytes rendered diabetic urine somewhat turbid; and in a short time a slight precipitation took place of a white salt, which was sulphate of barytes. The same re-agent produced a like effect upon healthy urine: but the precipitate was rather more abundant, and of a brownish red colour. 6. Oxalic acid afforded with diabetic urine a light rose-coloured flocculent precipitate, of which a considerable part was held in suspension in the liquor. The same acid threw down a precipitate with healthy urine, but it was heavier and of a deeper colour. 7. Sulphate of mercury rendered diabetic urine slightly turbid, and gave it the appearance of a white salt. A precipitate of a reddish tinge gradually occurred, one-half of which remained suspended in the liquor. Treated by the same re-agent, healthy urine assumed a brownish red tinge: the precipitate resembled a lilac-coloured salt, and was wholly deposited at the bottom of the vessel. It was the phosphate of mercury. 8. Pure potass rendered diabetic urine turbid, and afforded a small portion of ammonia; a white precipitate was afterwards procured in small quantity. The precipitate afforded by the same re-agent with healthy urine was on the contrary abundant, and the disengagement of ammonia very considerable. 9. Muriate of lead communicated to morbid urine a milky colour; the precipitate which ensued was that of a white salt, slightly tinged with red; it was a phosphate of lead: the liquor remained transparent. Muriate of lead imparted to healthy urine a violet colour, and produced a red precipitate; the liquor remaining of a brownish red colour. 10. Diabetic urine precipitated nitrate of mercury of a rose colour, and the liquor became as limpid as water. The precipitate of nitrate of mercury by healthy urine was also of a rose colour, but more abundant; and the liquor preserved a brown tinge.

Analysis by Evaporation.—1. After exposure to the air during six weeks, (from 10° to 12° Reaumur, 54° to 59° Fahr.,) diabetic urine became turbid within the first six days, and gradually deposited a white flocculent substance, which was found to be albumen. The liquor afterwards became limpid and slightly coloured, having a sour odour and acid taste exactly resembling vinegar made with milk. Healthy urine, after like exposure to the air during the same period, soon exchanged its natural odour for one that was strongly ammoniacal; its colour became brown, and in the end it putrefied, affording a very fetid and offensive smell. The precipitate was pulverulent, and composed of phosphate of lime, soda, and muriate of soda. 2. Diabetic urine became acid, and turned blue vegetable tinctures red; whereas, healthy urine, when putrid, rendered the same tinctures green. 3. This acid urine combined perfectly with carbonate of potass in solution, without marked effervescence; the liquor, after filtration and evaporation, furnished acetate of potash, mixed with a small quantity of phosphate of potash; the precipitate obtained was scanty, of a white colour, and composed of lime and a small portion of magnesia. 4. Four pounds of diabetic urine afforded, on evaporation carefully conducted, four ounces and a half of extract, of the consistence of honey, of a brown colour, like to treacle, and having the odour of burnt sugar; whereas only three ounces six drachms of an extract of the consistence of honey, of a very brown colour and urinous odour, were obtained from four pounds of healthy urine. 5. Ten parts of diabetic extract were mixed with four of muriate of lead and one of powdered charcoal, and after being dried they were submitted to distillation in a retort. Little or no ammonia was afforded, but carburetted hydrogen and a black fetid oil. The residue in the retort, on being subjected to an intense heat, gave no traces of phosphorus. The extract of healthy urine, treated in the same manner, furnished ammonia and a fetid oil; the residue contained some muriate of ammonia, and when thrown upon ignited charcoal, emitted the odour of phosphorus. 6. One ounce and two drachms of diabetic extract being treated with four ounces of alcohol, at 35° Reaumur, afforded a yellow fluid resembling Spanish wine; the solution of the matter was nearly complete, and the liquor deposited, in the space of twenty-four hours, a light, flocculent, grey substance, which, when washed and dried, weighed only twenty grains; its taste was saline and slightly sweet. Lime-water, added to one portion of the residue, afforded a feeble ammoniacal odour; sulphuric acid, applied to the other portion, changed it to a black colour, and produced the odour of sulphurous acid gas, indicating the presence of albumen. An equal quantity of the extract of healthy urine, treated with alcohol, afforded an abundant precipitate, composed of the phosphates of magnesia, lime, soda, and ammonia, uric acid, benzoic acid, and albumen. Urea and the muriates of ammonia and soda were held in solution in the liquor. In order to obtain these different substances separately, the fluid was evaporated, and the residue being dissolved in water, nitric acid was added to it, which occasioned a copious precipitate. This precipitate was found to be a nitrate of urea. 7. On submitting diabetic extract to distillation with nitric acid, nitrous vapour was disengaged; the residue being dissolved in distilled water afforded, on evaporation, oxalic acid, and a small portion of phosphoric acid. 8. Four ounces and a half of diabetic extract, of the consistence of honey, being dissolved in a pound of distilled water, with half an ounce of yeast added to it, and exposed to a temperature of 15° Reaumur during twenty-four hours, readily fermented, and afforded a considerable quantity of carbonic acid gas. After the fermentation was over, the whole being submitted to distillation yielded ten ounces of a spirituous liquid. Such were the chief methods employed by MM. Nicolas and Gueudeville, with the view of establishing the peculiar nature of diabetic urine. Dr. Bostock also submitted portions of diabetic urine to the action of different re-agents. His experiments, as well as those of Cruikshank, Nicolas, and Gueudeville, satisfactorily prove that the different salts exist in diabetic urine, nearly in the same proportion to each other as in the healthy state of the fluid, but that they amount only to about one-third of the absolute quantity. Sometimes diabetic urine has been found to contain a small portion of blood, (as in the case of Stevenson, related by Dr. Watt,) and occasionally a white milky-like fluid resembling chyle. Having thus noticed the principal circumstances connected with the *urine* in diabetes, it may be proper to allude to the state of the *blood* in that disease.

Analysis of the Blood in Diabetes.—Nicolas and Gueudeville, Wollaston, Marcet, Henry, and some other eminent chemists, have performed many experiments to determine the existence or non-existence of sugar in the blood of persons labouring under diabetes mellitus. Dr. Rollo stated (in the case of Captain Meredith) that the patient was bled, and the blood was kept for several months without undergoing any putrefactive process; while a portion of healthy blood, taken at the same time and placed in the same room, exhibited evident marks of considerable putrefaction in four days, and was obliged to be thrown away on the seventh. Nicolas and Gueudeville ascertained that the blood of diabetic patients afforded some serum, a small quantity of fibrine, and was less animalized than that of persons in good health, but that it contained no saccharine matter. Having satisfied himself how the albuminous part of healthy serum could be most completely coagulated, and by what appearances the presence of sugar that had been added to it would be most easily discerned, Dr. Wollaston added half a drachm of muriatic acid, previously diluted with one drachm and a half of water, to six drachms of serum, and immersed the phial containing them in boiling water during four minutes. In the course of a few hours a drachm or more of water exuded from the serum that had been so coagulated. A drop of this water being evaporated, the salts which it contained were found to crystallize, so that the forms of the crystals could be easily distinguished; they were principally common salt. If any portion of saccharine matter were added to the serum previous to coagulation, the crystallization of the salt was impeded, or wholly prevented, according to the quantity of sugar present. By the addition of ten grains to the ounce, the crystallization of the salts was entirely prevented, and the degree of blackness and disposition to deliquesce was of course more manifest than with smaller quantities. As a further test of the absence or presence of sugar, Dr. Wollaston added a little nitric acid to the salts that remained after crystallization of the drop. He found that when the serum had been successfully coagulated without any addition of sugar, the nitric acid merely converted the muriatic salts into nitrates, and nitrate of soda was seen to crystallize without foam or blackness. But when sugar had been added, a white foam rose round the margin of the drop, and if further heat were applied it became black, in proportion to the quantity of sugar present. On applying the above tests to diabetic blood and serum, Dr. Wollaston failed to detect any traces of sugar. Dr. Henry performed some interesting experiments on diabetic blood, as noticed by Dr. Ferriar, which confirm the results of Dr. Wollaston's analysis. Dr. Prout has also made a comparative examination of the blood of a person labouring under confirmed diabetes, with healthy blood. He states that he was induced to undertake it with the intention principally of determining whether the quantity of azote was the same in each. The diabetic blood presented the usual appearances of healthy blood. The following were the results of his experiments:—

Specific gravity of the serum of diabetic blood	1029·5
——————— of the urine of the same person, voided at the same time	1044·6
One hundred grains of the diabetic serum, evaporated and dried to the standard formerly mentioned, left ten grains of solid matters, which upon analysis were found to consist of albumen	8·7
Lactates and animal matters usually existing in the blood	·6
Salts	·7
	10·

"Which very nearly coincide," says Dr. Prout, "with the proportions ascertained by Dr. Marcet and Berzelius to exist in the serum of healthy blood. One hundred grains of the diabetic urine, evaporated and dried as before, left 11·7 grains, nearly the whole of which was sugar. Portions of albumen from the serum of this diabetic blood, dried and analysed as before, yielded *precisely the same results* as albumen from the serum of healthy blood."—"To ascertain," Dr. Prout continues, "the relative proportions of azote present in the diabetic urinous extract and the extract from healthy urine, portions of them were burnt with the oxide of copper. The results were, that one hundred parts of the diabetic extract (abstracting alkaline and earthy salts) yielded only 6·5 parts of azote, while the same quantity of extract from healthy urine yielded from thirty-five to forty parts of the same principle. To obviate the objection that the saccharine matter of the urine might be formed from the other principles of the blood and not from the serum, comparative experiments were made with the *cruor* of healthy and of diabetic blood. The results were precisely similar as to the quantity of azote in both, and at the same time the quantity of azote did not differ much from that found to exist in the serum above mentioned." From these experiments of Dr. Prout's, it may be safely inferred that the blood of diabetic patients contains an equal quantity of azote with that of healthy persons.

We may observe here, that Dr. Wollaston thought that, in order to account for the presence of sugar in the urine, we must either suppose a power in the kidneys of forming this new product by secretion, or—if we admit that the sugar is formed in the stomach by a process of imperfect assimilation,—must then allow the existence of some channel of conveyance from the stomach to the bladder without passing through the general system of blood-vessels. He conceived, that if prussiate of potass could be taken with safety, its presence would be discerned by a solution of iron in as small a proportion as almost any known chemical test. Finding that a solution of this substance might be taken without the least inconvenience, and that in less than one hour and a half the urine became perceptibly impregnated with it, although the quantity employed had not amounted to more than three grains of the salt, be administered to a healthy person, about thirty-four years of age, a dose corresponding to three grains and a half of the dry salt, and repeated it every hour to the third time. The urine being examined every half hour, was found in two hours to be tinged, and to afford a deep blue colour at the end of four hours. Blood was then taken from the arm, and the coagulum, after it had formed, was allowed to contract so that the serum might be fully separated. He then endeavoured to ascertain the presence of the prussiate by means of a solution of iron, but without effect. Dr. Marcet also performed several interesting experiments at the request of Dr. Wollaston on this point. In one experiment he administered five grains of prussiate of potash dissolved in water, to a young woman labouring under diabetes mellitus; and the proportion was repeated every hour till she had taken thirteen or fourteen such doses. After the fifth dose, her urine, by the addition of a drop or two of a solution of sulphate of iron, turned blue instantly. At this period of the experiment, a blister was applied to her stomach, and after a few hours, whilst still taking the prussiate of potash, and whilst the urine strongly indicated its presence, the blister was cut and the serum collected. This serous fluid being, in the same manner as the urine, subjected to the action of a solution of sulphate of iron, did not suffer any change of colour in the least indicative of the presence of prussic acid. Yet the urine still remained capable of imparting a blue colour to solution of iron, fifteen hours after taking the last dose of the prussiate of potash. Dr. Marcet afterwards repeated Dr. Wollaston's experiments on the serum itself, and with a similar result. He also found that the susceptibility of the passage by which prussiate of potash is transmitted to the bladder seems to vary in different individuals; for in five trials he failed to discover any vestige of that salt in the urine of persons who had taken it in quantities sufficient to produce its appearance in others.

These experiments, though highly interesting and ingenious, still fail to establish the fact of a direct communication between the digestive organs and the kidneys or bladder, by which sugar may be conveyed from the former to the latter without its entering the general circulation. It is known that other substances are also met with in the urine, such as urea and lithic acid, which have never been detected in the blood or other fluids of the body. We have ourselves also carefully analysed the blood taken from several diabetic patients, but never could detect the existence of sugar in it, nor indeed any marked difference in its chemical composition from blood in the healthy state. Hence, it may be concluded that saccharine matter does not exist ready formed in the serum of diabetic blood; unless, indeed, we suppose with some modern Continental writers, that sugar, like mercury, upon entering the blood, unites itself intimately with the albumen, and constitutes a new compound of unknown properties, and which consequently sets our tests at defiance, although easily decomposed by the glands, of which organs this species of separation seems the natural office. It is not more difficult to conceive how a kidney strongly excited by a redundant efflux of blood to its tissue, should convert part of the elements of the latter into sugar, than that the mammary glands of a woman should be found to perform the same thing in the sugar of the milk which it secretes upon a similarly sudden determination of blood to it after parturition.

[This negative evidence has been suffered to prevail with the generality of pathologists, although it had been observed that the fluid of transpiration was sweet. Recently, too, as before observed, saccharine matter has been detected in the saliva. It is clear, therefore, that the blood whence these secretions are formed must contain sugar or the elements whence it was formed. Of late, however, respectable chemists have affirmed, that they have unequivocally discovered saccharine matter in the blood. To obtain diabetic sugar, the serum was coagulated by Mr. M'Gregor, and carefully dried by heat. The solid mass being divided as minutely as possible by a pair of scissors, was boiled in water, and the decoction having been filtered through paper was evaporated to a certain extent. The concentrated liquid, on the addition of yeast, fermented strongly for several hours. Not satisfied with these results, and desirous of tracing the presence of saccharine matter still farther back, Mr. M'Gregor instituted several experiments, from which he is led to infer, that the stomach in diabetes, forms a preternatural proportion of sugar, and that the admission of the saccharine matter into the chyliferous vessels, and the consequent presence of a material in the blood, which is foreign to its healthy composition, is the cause of the different morbid phenomena of diabetes;—the kidney merely separating—as the great depuratory organ—the foreign material conveyed to it from the blood.

Pathology of Diabetes.—It is matter of regret, that hitherto the most careful anatomical research has afforded no satisfactory information concerning the origin of this complicated malady. Various morbid changes have been detected on the post-mortem examinations of diabetic patients, but these, in not a few instances, may more properly be considered as the effects than as the causes of the disease. The kidneys are more frequently met with in a morbid state than any of the other abdominal viscera; their size is occasionally much augmented. In four fatal cases under our own observation in immediate succession, these organs were greatly enlarged, and the ureters were considerably dilated. Dr. Duncan has related a case of diabetes in the Edinburgh Clinical Reports, in which the kidneys were much larger than common; and Dr. Rutherford and other pathologists have noticed an unnatural increase of their size. The texture of the kidneys in some instances is firmer, in others more flaccid than usual; their vessels are also occasionally preternaturally enlarged; and their surrounding cellular membrane has more than once been found filled with a gelatinous substance. In the case of Robinson, mentioned by Dr. Rutherford, the kidneys were much augmented in bulk, soft, and their surfaces painted with numerous vessels; the vessels were uncommonly dilated. The emulgent vein of the right side was not under three-fourths of an inch in diameter, as it appeared distended with blood. The ureters also were considerably dilated; the bladder seemed capacious, its coats thickened, and it was half filled with liquid. In the dissection, too, of Ann Laidlow, given by the same author, the kidneys were found somewhat enlarged, and on cutting into them the tubuli uriniferi were more distinct than usual, and the pelvis of each was also considerably increased; but no other morbid change of structure was perceived. Mr. [Sir B.] Brodie, on examining the kidneys of a patient of Dr. Warren's, who died of diabetes, found them to possess an unusually firm and grisly texture. In order to ascertain the state of the blood-vessels, he injected one of the kidneys with size and vermilion previously to examination; the other was allowed to remain in its natural state. On cutting into the substance of the injected kidney, the cortical part appeared unusually red, and the cryptæ were seen more numerous, larger, and more distinct than ever occurs under circumstances of the most fortunate injection. The blood-vessels of the cortical substance of the kidney which had not been injected were unusually turgid; the ureters, emulgent artery, and vein, were of natural dimensions; the renal capsules were firmer and harder in their texture than usual, and seemed to partake of the grisly structure of the kidneys: the bladdder was sound. M. Dezeimeris noticed the increased bulk of the kidneys in three cases of diabetes, which occurred at the Hôtel Dieu in one year. "In all the cases the volume of the kidneys was much enlarged; all their vessels were considerably developed, and their tissue, which was gorged with blood, and of a deep red colour, could be torn with the greatest facility." It appears from an interesting and extremely minute examination of a case of diabetes conducted by Dr. Monro, that all the glands of the absorbent system were either enlarged or morbidly altered in structure. Upon dividing the right kidney into two equal portions by a longitudinal incision, it seemed as if it had been very successfully injected. Many blood-vessels, both in the cortical and medullary part, were filled with florid blood, owing to which the distinction between these parts was not well defined. A transparent yellow-coloured substance was found effused on the outer side of the pelvis and infundibula.

Dr. Beer met with a very remarkable degeneration of both kidneys in the body of a young man, who had for a long time laboured under diabetes. They were extended by hydatids, contained in their interior substance, to such an enormous size that each was one foot long and seven inches broad, and the ureters were of the size of the thumb.

The ureters and bladder are sometimes considerably dilated. In one instance, Dr. Duncan found the bladder capable of containing five pounds of urine, and he states that about that quantity remained in it after death. It had its natural form, and its parietes were rather thinner than usual, although the muscular fasciculi were very well marked. Its inner coat presented a perfectly healthy appearance, and the ureters were about one-fourth of an inch in diameter: the sympathetic and splanchnic nerves were also enlarged to nearly three or four times their usual size. In the dissection of a diabetic patient of Dr. Pearson's, mentioned in Dr. Rollo's work, the kidneys were found to be in a perfectly sound state, and so were the ureters; but the urinary bladder was much thickened, and the urethra was dilated to three or four times its usual width; in another, related by Dr. Marshall, the kidneys had assumed a chocolate colour, were large, and the texture soft and flaccid, particularly that of the portion comprehending the tubuli uriniferi: the bladder exhibited nothing unusual. In the case of Oliver Ormrod, detailed by Dr. Clark, the ureters were very much dilated, and through their whole course measured full half an inch in diameter. In two cases, we have found the bladder much contracted and thickened. In one instance the capacity of this viscus was so much diminished as not to admit more than a small egg; in the other, the parietes of the bladder were even more thickened.

As post-mortem examinations in cases of death from this disease are always interesting, we shall detail the following one which recently occurred in our own practice. The external cutaneous veins were distended with fluid blood. On detaching the scalp, some ounces of blood issued from the cut surface; the pericranium was redder than usual. The encephalon, and its containing membranes, appeared free from disease. On raising the sternum from the pleura, there were exhibited no traces of recent inflammation, but exudations of coagulable lymph appeared on the surface of the pleura pulmonalis, which had formed pretty strong bands or partial adhesions to the pleura costalis, particularly on the right side. Lungs sound. Nine ounces of fluid were found in the right cavity of the thorax, and eight ounces in the left; the quantity of liquor pericardii was about half an ounce. Gall-bladder distended with bile. Liver larger than usual, and of a firmer consistence. Spleen of natural size, though rather denser than common. The urinary bladder was full. The left kidney had undergone a remarkable diminution in bulk, being not more than one-third of its usual size. After the removal of fat, &c. it weighed ten drachms (troy weight); it was otherwise healthy, with the exception of some small *hydatids* on its surface. The right kidney weighed five ounces six drachms (troy weight); its surface was a little irregular. The stomach was inflamed on its posterior side and next the cardia; the inflammation only affected the inner membrane, which was also slightly corroded by the gastric juice. It contained five ounces of half digested cream-like fluid. In this instance, the diminished size of the left kidney formed the most singular feature in the dissection.

MM. Dupuytren and Thenard, on the examination of a diabetic patient, met with the stomach in a very much enlarged state: its vessels were greatly dilated, and forming upon the internal membrane of the organ a red net-work. It also contained a considerable quantity of uninflammable gas, and a small portion of a greyish liquid, in which were floating seven or eight small, yellowish, round, fatty substances. The duodenum, and upper part of the jejunum and ileum, were somewhat redder and thicker than natural; no appearance of disease was discoverable in any other part of the intestinal canal. The liver, spleen, and pancreas were sound. The gall-bladder was moderately filled with healthy bile. The kidneys were at least one-third larger than usual; their structure was soft and of a grey colour, but in every other respect natural. The other organs connected with the urinary apparatus were free from disease, though the bladder was very small. The abdominal lymphatic system, and the thoracic duct, were more than ordinarily developed. The arterial and venous systems had undergone no morbid alteration. The lungs adhered to the sides of the chest by loose cellular tissue. In the right lung there were some small vomicæ containing pus; in the left, several cysts completely filled with an elastic fluid. The muscles were pale and flaccid, but otherwise in structure quite healthy.

Dr. Baillie has also left an account of the post-mortem examination of a person who had been long affected with diabetes, and had been a patient under his care in St. George's Hospital. The state of the kidneys is very minutely noticed. "Both were of the ordinary size and shape. When the proper capsule was removed from each, the veins on the surface were much fuller of blood than usual, and had an arborescent appearance. When the substance of both kidneys was cut into, it was observed to be every where much more crowded with blood-vessels than in a natural state, so as in some parts to approach to the appearance of inflammation. Both kidneys had the same degree of firmness to the touch as when healthy, but they were hardly so firm as kidneys usually are the vessels of which are so much filled with blood. A very small quantity of whitish fluid, a good deal resembling pus, was squeezed out from one or two of the infundibula in both kidneys, but there was no appearance of ulceration in either. The artery and vein passing into the cavity of each kidney presented exactly the natural appearance. After separating, a good deal, the cellular membrane which joins together the blood-vessels, was discovered a lymphatic passing from one of the kidneys: it was of the usual size, had the common valvular appearance, and was empty. There were doubtless several others belonging to both kidneys, but they were so small as not to be distinguishable. The nerves of the kidneys were of the usual size, and the ureters of both were perfectly natural. The renal capsules appeared quite healthy. The structure of the liver, stomach, spleen, pancreas, intestines, and urinary bladder, was perfectly natural, but one or two of the mesenteric glands contained a considerable quantity of earthy matter."

Organic changes are sometimes discovered in the internal structure of the kidneys in diabetes. We may state as a pathological fact of some importance, that in three instances of this disease we have detected the peculiar granulated or mottled condition of these organs, so well described by Dr. Bright as occurring in dropsical affections accompanied with albuminous urine. The cortical part had lost all appearance of its natural structure, and presented a tolerably uniform yellowish colour with many yellowish-grey spots. The mesenteric glands in two cases were much enlarged and indurated; and in the other, several vomicæ were detected in the right lung. There was no evidence of organic disease in the liver or in any of the other abdominal viscera in the latter instance.

Besides these morbid conditions of the kidneys and their appendages, a diseased state of the stomach and lungs has also been noticed in this affection. The former organ has been found to exhibit marks of inflammation, and the latter have been studded with tubercles in different stages of their progress. In a fatal case of diabetes, which occurred in the Manchester hospital a few months since, both lungs were tuberculated; and except dilatation of the pelvis of the kidneys and of the ureters, there was no perceptible disease of the urinary organs. The pulmonary affection was subsequent to the diabetes, therefore it cannot be said that this affection was excited by the former. In most of the dissections on record, the mesenteric glands have afforded evidence of structural derangement; and from our own observation we should say, that next to the enlarged and flaccid state of the kidneys, this is the most uniform morbid appearance in diabetes. We not unfrequently meet with similar disease of structure, however, in diseases very different both in their nature and symptoms from the one under consideration; hence, it is not singular that such an infinity of hypotheses should have been advanced to account for the phenomena of this malady. In some examinations of diabetic patients no trace of organic disease has been discoverable. An intelligent practitioner informed us during the last year, that he had recently examined the body of a young man, twenty-one years of age, who had died of this disease, without being able to detect the least deviation from healthy structure in any of the cavities.* The different morbid appearances in the stomach, liver, and lungs, noticed above, are undoubtedly in some instances merely accidental attendants; and indeed the diseased state of the kidneys themselves is, we conceive, mostly the consequence of long-continued morbid action. The ureters, too, become dilated, and the bladder contracted and thickened, from the constant passage of such an increased quantity of urine. From these observations, it is evident that the information regarding the nature of diabetes derived from dissection is very unsatisfactory, and that up to the present period we are ignorant of the *essential pathology* of the disease. With so defective a pathology, the treatment must necessarily be vague, and in a great measure empirical.

The Treatment of diabetes mellitus comes now under consideration. The statements respecting the cure of diabetes furnished by the ancient writers on this disease are altogether unsatisfactory. This cannot be matter of surprise when it is considered that they regarded only the unnatural quantity of the urinary discharge, being entirely ignorant of any morbid alteration in its qualities. As it would answer no useful purpose either to enter into an examination of the comparative value of the whole of the modes of treatment that have been proposed, or to dwell at any length upon the particular remedies which have been recommended, on various authority, for its removal, we shall first merely notice the four branches of cure, *animal diet*, *venesection*, *opium*, and *astringents*, which of late years have been chiefly adopted; and then point out those principles of treatment which seem to us to be best calculated to arrest the progress and remove the symptoms of the complaint. Dr. Home first suggested the employment of animal diet and alkalies, with a view to their specific operation as septics; but Dr. Rollo is entitled to the high merit of having put into practice the rigid use of an animal regimen as the most effectual mode of curing diabetes. The employment of this plan is founded on the principle of preventing the introduction of the materials of which sugar is formed into the system, and of thus destroying the saccharine impregnation of the urine. Dr. Rollo also combined with an entire abstinence from vegetable food the exhibition of the hepatized ammonia, and the occasional interposition of narcotics and emetics. Dr. Rollo's practice has long since enjoyed a fair trial in the hands of many distinguished practitioners, and consequently sufficient time has been allowed to admit of a correct inference being drawn respecting its real claims to the high character bestowed upon it by so able an advocate. Without particularising individual cases in support of the efficacy of a strict adherence to animal food in removing some of the more formidable symptoms of diabetes, it may be stated that its power of abating thirst, diminishing the unnatural quantity of the urinary secretion and rendering it more animalized, of relaxing the skin, and of increasing the bulk and strength of the body, rests on the incontrovertible evidence of facts and experience. Its influence upon the urine is in general speedy and favourable, and though perhaps when employed *singly* it may prove on some occasions inadequate to the perfect cure of the disease, still, under almost all circumstances, it will be found to act as a powerful auxiliary to venesection, opium, or the other means which may be adopted. Dupuytren and Thénard have contended that diabetes may be as readily subdued by animal diet as an intermittent by the use of the cinchona bark. Dr. Baillie, in alluding to Dr. Rollo's method of practice, observes that it has been much more successful than any other hitherto adopted. Dr. Bardsley has also shown the advantages derived from confining diabetic patients to animal food. Several of his cases strongly exemplify the reduction in the quantity of the urinary secretion, and the disappearance of its saccharine properties, which speedily followed the use of this regimen. Dr. Willan states that this disease has been relieved, and the saccharine quality of the urine removed, by animal diet and the general plan recommended by Dr. Rollo. Were it necessary, other respectable authorities might be adduced in support of the curative value of the same method. We have adopted the animal regimen in several instances with the most marked and unequivocal benefit, and have known patients, who have had sufficient means and resolution to persevere in its use for some length of time, not merely to recover their wonted health, but overcome the tendency to the disease. Owing to the high price of meat, but few of the poorer classes of persons who have the misfortune to labour under this complaint are capable of a strict compliance with this plan of treatment, for the amount of their daily labour is mostly insufficient to procure such a supply as the appetite demands. This is not the only obstacle to the employment of animal food as a remedy in diabetes; for there is often considerable difficulty in keeping the patients for any length of time exclusively confined to such a regimen; and many failures with this method of treatment may be attributed to a secret indulgence in variety of aliment. In some instances there is an insuperable disgust at the taste, smell, and even sight of animal food. With the ordinary class of hospital patients it is extremely difficult to prevent a deviation from the prescribed plan of diet. Dr. Rollo himself laments that the mode of cure which he proposed is so contrary to the inclinations of the sick. "Though perfectly aware," he observes, "of the efficacy of the regimen, and the impropriety of deviations, they commonly trespass, concealing what they feel as a transgression to themselves. They express a regret that a medicine could not be discovered, however nauseous and distasteful, which would supersede the necessity of any restriction of diet." This aversion, however, to the animal regimen is by no means general, for in some instances it has been adopted with little or no inconvenience, and even been continued by the patients from choice, when a certain allowance of vegetable food has been permitted by the physician. Dr. Marsh rather overrates the loathing of animal food on the part of diabetic patients, when he asserts that the adoption of the animal regimen, during even fourteen days, is, in his opinion, more than questionable. In some of the cases published by Dr. Bardsley, the exclusive use of animal food was continued for more than two months. We occasionally visit a lady who has laboured under diabetic symptoms for more than nine years, and during the greater part of that time she has adhered, with scrupulous exactness, to the use of animal food.

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* In a dissection of a diabetic patient of Dr. Forbes, no morbid lesion could be detected except slight enlargement of the kidneys, and a remarkably hypertrophied state of the duodenum. It was simply hypertrophy, without any mark of inflammation or alteration of tissue.

It must be recollected, however, that there is a certain period at which it is necessary to combine vegetable with animal diet. When the more urgent and characteristic symptoms of the disease are subdued, and at the same time the strength and bulk rather diminished than increased, and the appetite is feeble and impaired, it is proper to allow a small proportion of vegetable food. The salutary effects of this change are soon rendered visible in the improvement of the appetite, and the acquisition of flesh, strength, and spirits. It has been remarked, also, that whenever a return to vegetable diet is allowed not only with impunity but advantage, it forms the surest criterion of the restoration of the assimilating powers of the system, and consequently of the removal of the disease. It is necessary, however, to caution patients against indulging too freely at first in the use of vegetable diet after a long and rigid adherence to animal food, as they are apt, from the agreeable nature of the change, to relinquish the latter regimen altogether, and thus favour a reproduction of the disease. At this stage, the state of the digestive organs requires particular attention in order to establish on a firm footing the benefit obtained; for if the stomach and bowels are permitted to become deranged by irregularities in diet, the danger of a relapse may be apprehended. Bitter tonics, mild aperients, chiefly rhubarb and magnesia, and sea air, prove eminently useful in promoting the tone of the system. It is by no means intended to recommend animal diet as the only mode of subduing this obstinate disease, but to show that no other, without its aid, will have the same influence in arresting the progress of the diabetic symptoms.

Previously to commencing with the sole use of animal food, it is of the first importance to have the stomach and bowels brought into as natural a state as the character of the complaint will allow. Costiveness must be obviated by the regular use of mild aperients, and for this purpose castor oil is preferable to the saline class of purgatives. The first effects of this plan of treatment should be very carefully watched, as there is considerable risk of the sudden occurrence of acute inflammation of the thoracic or abdominal viscera when it is adopted shortly after an entire abstinence from vegetable food. We have more than once been obliged to modify the practice on this account. The liability to inflammation under the animal regimen is strikingly exemplified in the case of James Ridens, aged 26, who was admitted into the Manchester hospital on the 2d of August, 1824, labouring under the ordinary symptoms of diabetes. The quantity of urine passed in the twenty-four hours amounted to nearly two gallons. One pint yielded, on evaporation, 1 oz. 4 drs. and 8 grs. of a thick sweet syrup. He had lost all venereal appetite, and his semen was involuntarily discharged. Animal diet was prescribed, and the nitric acid mixture was ordered for common beverage. His bowels were opened by the aid of castor oil. On the 5th the urine was diminished more than four pints, and the patient said that it was somewhat less sweet to the taste. He had no aversion to animal food. Early on the 8th he was suddenly seized with a severe pain in the epigastric region, which was much aggravated under the pressure of the hand. The stomach rejected every substance received into it. The pulse was small and frequent, and the countenance indicated great uneasiness. Twenty leeches were instantly applied to the epigastrium, sixteen ounces of blood were removed from the arm, and a purgative enema was injected. In the evening the patient seemed somewhat relieved by the bleeding, but the pain of the epigastrium was still present. A copious evacuation followed the enema. The serum of the blood was milky, and the crassamentum firm. Pulse 120, and weak. A vein was again opened, and eighteen ounces of blood were abstracted; twelve leeches were applied to the epigastrium, and a pill with two grains of calomel, and two of extract of hyoscyamus, was directed to be taken every third hour. The pulse after the bleeding was 106. On the morning of the 9th, we found the patient much worse, and evidently sinking very rapidly. He could with difficulty reply to the questions put to him. The pain of epigastrium was diminished, but the pulse was tremulous and intermitting, and his extremities were cold. His bowels had been moved twice during the night. Anodyne fomentations were applied to the epigastrium, weak wine and water was administered, and bottles of hot water were applied to the feet. He expired in the course of the afternoon. His friends, though urged by frequent solicitations, obstinately refused to allow an inspection of the body. From the above reports, however, it is highly probable that Ridens died of inflammation of the stomach, induced by an unlimited use of animal food. At first, it was imagined that the sudden attack which proved fatal might have been owing to over-repletion; but he had retired to rest as well as usual, and even complained of severe pain of epigastrium before breakfast, which was generally with him a very hearty meal. In the case, too, of John M'Lean, related by Dr. Cleghorn, it appears that, although his diabetic symptoms were much relieved by the use of animal food, still the pneumonia which destroyed him was induced by strict adherence to this regimen.

It may be remarked here, that M. Rochoux prescribed urea to a diabetic patient, (whose blood was analyzed by MM. Vauquelin and Ségalas without finding in it any trace of sugar,) and it was continued for several days; but the urine, which was increased in quantity, afforded, on careful chemical examination, no urea.

Very opposite to the above plan of treatment recommended by Dr. Rollo, is that of depletion, by *copious* and *repeated bleedings*. Dr. Watt was first led to try venesection from the circumstance of his patient expectorating blood, and from having in mind the case of Captain Meredith, (related by Dr. Rollo,) who, on the evening after bloodletting, "felt lighter, cooler, and more cheerful, and had less pain about the kidneys." On the following day Dr. Watt's patient seemed much relieved, the quantity of urine had diminished, the crassamentum of the blood was black, and void of tenacity. Finding so much relief from the first bleeding, he resolved on a second, and eighteen ounces were accordingly taken from the arm; an animal diet was enjoined, and carbonate of ammonia prescribed to obviate acidity. By repeated bleedings and a similar diet and medicines, in about four months this patient was restored to health. The following is the statement of Dr. Watt's mode of treatment. "The treatment according to my plan is to reduce the quantity of blood already in the system, to diminish the supply of new materials, and to afford a certain proportion of stimuli. The first is accomplished by venesection; the second, by abstinence; the third, by blistering, mercury, &c. The effect of this treatment on the system is increased re-action, indicated by some degree of fever, and terminating in the restoration of all the secretions." It is to be regretted that the same result has not attended the employment of bleeding in cases of diabetes occurring to other practitioners.

Dr. Watt appears to have tried venesection in one or two instances under the most untoward circumstances, the pulse being slow and feeble, the strength reduced, and the lower extremities œdematous; and still with benefit. Even the first bleeding sometimes produced an evident improvement in the symptoms. In the case of Stevenson, the fifth bleeding acted like a charm. "The recovery after this was instantaneous and striking. The painful sensation in his bowels left him; the power of virility returned; the gums became sound; the skin soft and perspirable; the saliva, the urine, and the alvine discharge natural; in six days he returned to his work: in two months he was restored to his original health."

Dr. Watt found that the blood first drawn in diabetes was thin and destitute of buffy coat; the coagulum being so soft and weak that it could not support its own weight. As the operation was repeated, the blood assumed more and more an inflammatory character, and often exhibited ultimately a thick buffy coat, and a strong, firm, and tenacious crassamentum. "The improved texture of the blood," he observes, "as venesection was repeated, the increased hilarity of mind, and general renovation of the living functions, warrant the conclusion, that, however weakening it may be in particular circumstances, bloodletting is a most important mean of disburdening the system, and of preparing the way for the final re-establishment of health and vigour." Mr. Murray has also related a case in the eighth volume of the Edinburgh Medical and Surgical Journal, in which the blood improved simultaneously with the health. Some other instances have been recorded, illustrative of the salutary change produced in the constitution of the blood itself by repeated venesections. Dr. Ayre found bleeding useful in one example of this disease. The appearances of the blood strongly resembled those observed by Dr. Watt; and indeed, so close was the relation betwixt the state of the blood and the relief afforded, that the amount of the one was almost determinable by a view of the other. It is mentioned that during the first month the patient lost eighty-eight ounces of blood, and took at least only half the usual food, yet he gained nine pounds in weight, and acquired sufficient strength to follow a laborious employment. The marked good effects of venesection in two cases of diabetes have been ably shown by Dr. Satterly. His experience fully confirms the safety and efficacy of the practice in some species of that complaint.

We are enabled to speak of the *real* value of venesection in diabetes from a careful and fair trial of its influence upon the symptoms on several occasions. It is a remedy of the first importance during the acute stage of the disease, for it has the power of abating the thirst, reducing the quantity of the urinary discharge, and restoring the natural secretion of the skin. Under no other circumstances have we employed venesection with advantage, though blood has been abstracted from the system at regular intervals and to a considerable amount. The practice, indeed, on the contrary, has been attended with a diminution of the patient's strength without relief to the diabetic symptoms. Taking Dr. Watt for our guide, we have followed his plan of treatment with scrupulous exactness, with a view of determining its true claims to confidence, but we have had too often to lament the want of success which has followed its adoption. The experience of the profession at large would seem to confirm the statement just made; for the practice of venesection, so generally employed shortly after Dr. Watt's publication, is now, comparatively speaking, only partially pursued. We venture to recommend the employment of bloodletting during the early stages of the disease in persons of somewhat plethoric habit; and where the strength is not much reduced, and particularly when pulmonary irritation, as indicated by difficulty of breathing, slight cough, and shooting pains in the chest, may be present. The propriety of repeating the operation, and the frequency of the repetition, will be best determined by the effects produced upon the symptoms; for in some instances it may not be prudent to open a vein more than once, whereas in others no such restraint is necessary. There is sometimes an objection on the part of the patients to allow a fair trial of venesection, for feeling great debility and lassitude on the least exertion, they complain more of the want of a supply than of a superabundance of blood, and thus cannot be convinced of the benefit likely to accrue from such practice.

When general bleeding cannot with safety be adopted, the local abstraction of blood may occasionally be substituted with advantage. It has been our uniform custom in cases of this disease, to direct the application of leeches to the loins, when much pain and uneasiness have been experienced in the region of the kidneys, and always with good effect; and we have also found, with Dr. Marsh, that leeches on the epigastrium have been highly useful in removing the feeling of internal heat and tenderness so much complained of in that part. Indeed, patients have requested the repetition of leeches to the epigastrium on more than one occasion, being fully convinced of the benefit derived from them. This local bleeding has not materially reduced the strength, even when employed more than once. It should never be omitted under the circumstances we have pointed out, for though possessed of no curative efficacy, it is valuable in relieving painful and unpleasant symptoms, and is seldom, if ever, attended with harm, which is more than can be truly said of some other remedies proposed in this disease.

In a case of diabetes, under the care of Dr. Forbes, the first application of leeches to the epigastrium was *immediately* followed by a change in the urine to the healthy appearance. It was also much diminished in quantity. But the benefit was temporary, and although the same effect followed subsequent leechings, but in a less degree, the general result did not seem very beneficial.

Cupping is preferable to leeches when it is desirable to fix the precise quantity of blood to be removed, on account of the weakened state of the patient. Great benefit sometimes attends the application of blisters to the loins in cases of this disease. We have preferred the frequent repetition of blisters, to keeping the excoriated surfaces open by means of irritating dressings.

With the view of diminishing the nervous irritability of the system so generally present in this disease, the narcotic power of *opium* has been freely tried, and in many instances much benefit has attended its exhibition. It has also been prescribed with the intention of opening the skin, and exerting an astringent effect upon the kidneys, similar to that which it usually induces on the intestinal canal. Dr. Warren published two cases of diabetes mellitus treated with opium, in the fourth volume of the Medical Transactions, which afford satisfactory evidence of the influence of that valuable drug in restraining the quantity, and moderating or removing the saccharine quality of the urine. In one of the patients this desirable effect was produced after gradually increasing the proportion of opium to six grains twice a day; the sweetness of the urine returned on the diminution of the dose, but was again removed by increasing it. The other patient died, (although the original disease was subdued,) of phthisis pulmonalis. The dose was gradually augmented to five grains of solid opium four times a day. Dr. Elliotson has since exhibited opium in four cases of diabetes, in which the good effects of this remedy were satisfactorily established. He has administered it in large doses, but it appears more advisable not to push the quantity to any great extent. Dr. Prout also found opium useful in this affection. "All the beneficial effects," he observes, "to be really expected from opium, may in most instances be obtained by moderate doses only; and when thus judiciously exhibited, and when no peculiarity of constitution forbids its use, I believe that it will be found one of the most powerful remedies that we possess in this disease." Dr. Marsh, too, considers, that amongst the remedies hitherto employed, opium in very large doses ranks highest, for it possesses the property of checking and restraining the flow of urine, and depriving it of many of its morbid qualities. Our experience accords with that of the above named authors, but we have rarely found it necessary to administer more than six grains in the day, though on some occasions this proportion has been considerably exceeded; and when continued, during any length of time, in rather large quantities, this drug has produced alarming and pernicious effects. We are decidedly of opinion, that it proves most beneficial in moderate doses. Of late we have given the preference to the acetate of morphia, as it appears to exert an equally powerful influence upon the disease, without occasioning the pain of head and constipation which almost invariably accompany the free exhibition of opium. On the whole, opium is unquestionably entitled to be considered as a remedy of much value in diabetes, for it not merely diminishes the quantity of the urinary secretion, but also proves useful in removing uneasy sensations and calming mental agitation. *Astringents* constitute another line of practice which is very ancient, and is still resorted to by a considerable number of practitioners. They are recommended by Celsus, and from their natural tendency to correct every excess in secretion, have obtained considerable notice in the writings of almost every author since his time. That they prove beneficial by constricting the relaxed extreme vessels through which the urine filters into the papillæ of the kidney in diabetes, is the general opinion; but they may probably act also by an inherent sedative power, on which their astringent virtue seems almost entirely to depend. It is sufficiently proved by observation that they lessen the quantity of urine thrown off by the diabetic patient, up to a certain limit; but this they seldom can be made to pass; and they scarcely ever diminish the saccharine impregnation of the urine. By acting as tonics, however, and by lessening the sensibility of the stomach, they become useful auxiliaries in several modifications of the disease, and are chiefly objectionable when they are found to increase constipation. Celsus, however, trusted chiefly to a constipating diet, and strong rough wines. Sydenham used the rind of the pomegranate; Morton rhubarb, which was afterwards repeated by Professor Rutherford with advantage. Lime water, decoction of oak bark, infusions of kino and catechu, uva ursi, and diosma crenata, with many others, have lately been employed with the same intention as the above: but it may be fairly questioned whether alum, the vitriols, or indeed any astringent that ultimately stimulates, can safely be put in action for the cure of diabetes. Dr. Grahame, of Dalkeith, has lately published an ingenious method of directing the sulphate of zinc to the kidneys, by combining it with turpentine in the form of a pill; but even this mild preparation should be tried with caution.

Thus it appears that each of the four modes of cure mentioned above has strong claims to confidence and adoption, in certain forms and stages of diabetes. Before laying down what appear to be the correct principles of treatment, it may be proper very briefly to enumerate some of the individual remedies that have been employed for the removal of this disease. The phosphoric acid and its salts, as recommended by Dr. Latham, the phosphate of iron as used by Dr. Venables, in doses of one or two grains, gradually increased to a scruple or half a drachm, three or four times a day; the phosphate of soda, on the authority of Dr. Sharkey, who has published two cases of cure attending its exhibition; ammonia; calcined magnesia; tonics, such as the mineral acids, cinchona, myrrh, &c.; various bitters; mercury pushed to the extent of inducing salivation; chalybeates; cold bathing; and the colchicum autumnale, have been severally used in diabetic cases, and with various success. We have been informed by an intelligent medical friend, that he has of late exhibited the meadow saffron in two instances of this disease, and with a highly satisfactory result; but further evidence of its efficacy is required before it can be entitled to rank as a remedy in diabetes. Dr. Ferriar has detailed three cases of confirmed diabetes, in which a cure is said to have been effected by a combination of Peruvian bark, uva ursi, and opium, in the proportion of one scruple of each of the former to half a grain of the latter, administered four times daily, with the use of lime water for common drink. He treated this disease as one of debility. A case has also been related by Dr. Bateman, where the same practice was successfully adopted: but the disease returned after discontinuing the medicine, and did not so speedily yield to a repetition of it. In other hands this treatment has altogether failed. Dr. Shee has published a case, in the progress of which, after the ineffectual administration of astringents and opium, paralysis with convulsions of the whole of the right side supervened. In the course of ten days the patient was restored to health, (the diabetic symptoms yielded first, and afterwards the paralysis and spasm,) by a combination of camphor, kino, and oxide of zinc, with tonic infusions. Dr. Alley effected a cure general; in medicine it is employed to designate the distinction of diseases.

It is necessary, before giving a detailed view of the diagnostic arrangement of diseases, to enter upon the general consideration of symptoms, as the principal source on which the distinction of diseases depends; and as symptomatology, or the doctrine of symptoms, cannot properly be considered under *diagnosis*, we propose to treat of the symptoms and diagnosis of diseases under the term SYMPTOMATOLOGY.

MARSHALL HALL.

DIAPHORETICS, (διαφορητικὰ φάρμακα, from διαφορέω, *differo*, *discutio*, from διὰ, *per*, and φέρω, *fero*, *porto*,) are medicines that augment the function of perspiration. In order to understand the mode in which they operate, we ought to possess an accurate idea of the manner in which the cuticular function is performed in a state of health.

The importance of perspiration for the preservation of health is well understood, but the laws to which it is subjected are still imperfectly determined. It is a function of the whole of the skin; but whether it is possessed equally by every part of it, has not been ascertained: it is, however, probable that some parts perspire more freely than other parts. The perspiral matter passes off either in the form of a thin, invisible vapour, as *insensible perspiration*; or in a liquid form, as *sweat*. Various attempts have been made to ascertain the quantity of the cuticular discharge. From the time of Sanctorius, who first endeavoured to determine it experimentally, to that of Lavoisier and Séguin, little confidence could be placed on the results of the experiments, as the amount of the pulmonary exhalation was not deducted in calculating the loss which the body sustained in a given time. Lavoisier and Séguin overcame this difficulty, by inclosing the whole body in a silk bag, varnished with caoutchouc, having a small opening carefully cemented round the mouth, which permitted the person to breathe. The quantity of the cuticular discharge was thus determined to be one pound fourteen ounces in twenty-four hours; (Mémoires de l'Académie des Sciences, 1790, p. 610,) and, as this was the result of repeated trials, we may regard it as the average quantity in a state of health.

Many circumstances tend to vary the loss by perspiration, not only in different individuals, but in the same person at different times, and under a diversity of circumstances; as, for instance, the vigour of the frame, the nature and quantity of the ingesta, the temperature of the atmosphere, and many external relations. Thus perspiration is diminished immediately after a meal, but augmented during the process of digestion: it is also promoted during sleep; in a dry state of the atmosphere; in a current of air; and under a diminished barometrical pressure. But these circumstances are supposed to promote perspiration independent of vitality; and therefore Dr. Edwards has divided perspiration into that which results from ordinary physical influences, and that which is dependent on vitality or secretion; or into *exhalation* and *secretion*. Both are liable to be affected by external agents. In low temperatures, the loss by evaporation exceeds that by secretion, because cold suppresses secretion more than it impedes evaporation. It may, indeed, be maintained that even in a low temperature the cutaneous capillaries are still stimulated; and, consequently, that the portion of the insensible perspiration, which is the result of vital energy, must still be supplied: but it is in the ratio only of the stimulus which excites the vessels that furnish it: whilst the evaporation is less diminished, because the air being heated by contact with the body, is enabled to hold more moisture in solution than the air farther removed from the body; and thence evaporation is favoured.

One evident intention of perspiration is to prevent the temperature of the body from rising above that degree which a state of health requires, and to operate as a balance to the heating influence of increased arterial action. It also counterbalances other secretions; as for instance that of the kidneys, which is diminished as the perspiration is increased, and augmented when it is checked — a physiological fact of much practical value.

Many experiments have been made to ascertain the chemical nature of the perspired matter. From all that is known, it may be concluded that it consists chiefly of aqueous fluid, containing in solution some free lactic acid, lactate, muriate, and phosphate of soda, and an oleaginous principle: but there is also reason to believe that gaseous fluids are perspired by the skin with bases of nitrogen,* carbon,† and hydrogen;‡ and to the presence of the latter, variously modified by the accession of other constituents, some physiologists attribute the odour of perspiration. This odour, however, seems rather to depend on the secretions of the mucous follicles mingling with the perspiration, than to be a quality of this fluid, as it differs in different parts of the body.

Contemplating the nature of the perspiratory function, we may conclude that it is intended to answer two purposes:—1. to convey caloric from the body, and thereby to moderate and regulate its temperature; 2. to carry off a large quantity of carbon and hydrogen from the circulating mass.

Disease is frequently the consequence of a sudden check to the perspiratory function; means, therefore, have been sought for to restore it; and substances which have the power of effecting this are termed *diaphoretics*. Let us now inquire in what manner they produce their effects.

[The writer has elsewhere attempted to show (*General Therapeutics and Materia Medica*, i. 308: Philad. 1843), that in any mode of viewing the subject, it does not appear that we can ascribe any extensive series of morbid phenomena to simple obstruction of perspiration; and that, consequently, the indication of restoring suppressed perspiration, if it be admitted at all, must exist much less frequently than has been imagined.]

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* Vide Ingenhouz's Experiments; Expériences [illegible] les Végétaux, tom. i. p. 152; and those of Trousset, Annales de Chimie, tom. xlv. p. 73.

† Vide Experiments of Count de Milly: Histoire de l'Académie Royale des Sciences et Belles Lettres de Berlin, 1777, p. 35.

‡ Experiments on Insensible Perspiration, by W. Cruickshanks; Jurine's Experiments, Histoire de la Société Royale de Médecine, tom x.; and those of Abernethy, detailed in his Surgical and Physiological Essays.

Diaphoretics may operate in two ways:—1st, by stimulating generally, and so augmenting the force of circulation as to propel the blood forcibly through the minute vessels of the *corium*, by which both the secreting power of the skin, and the excretory function of the exhalents, is increased; 2dly, by the absorption of the diaphoretic substances taken into the stomach, and the direct application of these to the cutaneous capillaries.

In the healthy state of the system, perspiration is, probably, always the result of stimulating, either directly or indirectly, the cutaneous exhalents; and sweating follows increased vascular action, whether this arise from muscular exertion, or from substances taken into the stomach. But in disease, when the temperature of the body is augmented, the pulse is often frequent, indicating increased excitement of the general circulation, yet the skin remains dry. In this state there is evidently diminished action of the exhalents, whilst the cutaneous capillaries have their secreting power impeded; and, therefore, this condition must be overcome before diaphoresis can be produced. Those substances which augment the force of the general circulation, whilst at the same time they excite the cutaneous exhalents, will effect this desired change; few substances produce this double effect, alone, but it is readily induced by some combinations.

Those diaphoretics which operate by augmenting the force of the vascular system, increase the frequency and the power of the pulse, and raise the temperature of the body, previous to the flow of perspiration: on the other hand, those which act by stimulating the cutaneous exhalents without augmenting the force of the general circulation, exert a primary influence on the nervous energy of the stomach, and the skin responds by that inexplicable connection to which the term *sympathy* has been applied.

As the primary effect of diaphoretics is the evacuation of a large portion of the aqueous part of the blood, it might be supposed that this vital fluid would in consequence become thicker; but various circumstances concur to prevent such a result. Amongst others, thirst always accompanies sweating; and as this forces us to take fluids into the stomach, the waste of the aqueous matter thrown off by the skin is rapidly supplied. At this time, also, other fluid secretions are diminished, the urine, for instance; so that the watery matters which would be carried off by them are diverted to the surface, and several substances, which naturally find other outlets, are expelled by the skin. This is clearly demonstrated in some diseases. Thus, in cases of ischuria renalis, the perspiration has been found to contain uric acid and other traces of urine. Dr. Percival relates a case in which the perspired matter was so saturated with the salts of the refluent urine, as to crystallize on the surface of the body, in the form of a white powder. Such a condition of circumstances is, indeed, not surprising, when we consider that the suppression of one secretion induces an unusual action in the vessels of some other organ, and a changed condition of the secretion.

One unquestionably beneficial effect of diaphoretics is the determination of the blood from the interior to the surface, thereby relieving congestions, and maintaining that due balance of the circulation which appears to be essential to the preservation of health. Their salutary influence is also displayed in the increased power which they bestow on the absorbents, and in their relaxation of the surface in febrile affections. The relaxing effect of diaphoretics is indeed the most important property they possess as remedial agents, as it is on this power that their utility in inflammatory affections depends. Were it, however, attempted to induce diaphoresis in inflammatory or febrile affections by stimulating diaphoretics, the desired effect would not only be prevented from taking place, but the hazardous symptoms would be aggravated. Several circumstances, therefore, are requisite to be attended to, in the administration of this order of medicines: we shall mention those most important in a practical point of view.

1. Whenever diaphoretics are indicated, the patient should be confined to bed, but not overloaded with bed-clothes. If the pulse be full, hard, and quick, and the skin hot, bloodletting, if not contra-indicated by some peculiar circumstance, should preface the use of the diaphoretics; and the bowels should also be freely opened. It is a correct opinion, that free perspiration is not consonant with a quick, hard pulse, and a temperature of the skin exceeding 102° of Fahrenheit: in this state, if sweating occur, it is generally partial, and rather injurious than salutary. Even after the reduction of the phlogistic diathesis, the diaphoretics to be selected are those which nauseate and relax the surface.

2. The free use of diluents is necessary during the operation of diaphoretics, unless the stomach be in a highly irritable state. If antimonial diaphoretics, however, be employed, acidulated fluids should not be taken soon after the dose of the antimonial, as vomiting would be induced. When the temperature of the surface is high, the diluents should be cold; but when it is moderate, they should be tepid. So important, indeed, is dilution in promoting the action of diaphoretics, that the mere introduction of cold or tepid fluids into the stomach during the hot stage of fever, often produces diaphoresis.

3. During the operation of diaphoretics, it is essential to use bad conductors of caloric as coverings: both the body-clothes and the bed-clothes of the patient should be flannel, which, being of a light spongy texture, not only preserves an uniform temperature, but also absorbs the moisture as the perspiration flows. When linen is employed, the moisture accumulates in it, and aiding its conducting power, carries off the heat too rapidly from the body, and chills the surface. Attention to this circumstance is most essential, if it be requisite to keep up the sweating for ten or twelve hours longer, and especially if sleep become necessary during the continuance of the sweating. The older practitioners invariably resorted to the use of flannel during diaphoresis; a custom which has been too hastily condemned by modern practitioners, who recommend, instead of flannel, frequent changes of well-aired linen, asserting that this is more refreshing to the patient; that, from its comfortable feel, it has a tendency to allay irritation, consequently to aid in subdu-

ing the restlessness and inquietude of fever; and that it is essential for carrying off the fomes of the disease. The last part only of this opinion is well founded; and few practitioners would place a patient labouring under an infectious fever in flannel: indeed, under such circumstances, perspiration to the extent which requires the use of flannel is neither necessary nor desirable.

4. Attention must be paid to the *state of the bowels and kidneys.* If perspiration be requisite in a low stage of fever, purging must be studiously avoided, and should be checked if it occur spontaneously whilst the sweat is flowing; as it is almost certain to stop the sweating and to aggravate the disease, by diverting the blood to the interior, and exposing the patient to cold. The utmost caution, indeed, is requisite to prevent the admission of cold air to the surface; and no cold liquids should be taken into the stomach whilst the sweat is flowing, and for some time after it has ceased. During the administration of diaphoretics, every thing which has a tendency to promote the secretion of the kidneys should be avoided. The avoiding a frequent change of linen is in conformity with this rule, as, in affecting these changes, the surface must be necessarily exposed.

5. The morning, directly after sleep, is the best period of the day for administering diaphoretics, as the system is then easily excited, and the surface is relaxed: experience has demonstrated that many persons in whom perspiration cannot be induced at any other period of the day, may be readily made to sweat at that time. When perspiration accompanies diseases, it generally happens in the morning; there is then, also, a natural decline of febrile excitement; thence it is the most favourable time for the action of diaphoretics: and besides, as the administration of diluents is necessary to maintain the diaphoresis, this is the more convenient period for their administration.

6. When sweating is to be checked, the skin should be dried with soft warm towels; the patient should be carefully moved into dry flannels, and the coverings gradually lessened, allowing the arms to be cautiously exposed to the air. By these means, the injurious consequences, which might follow a sudden revulsion, are avoided.

Before entering upon the examination of those substances and means which are usually employed to promote diaphoresis, it may be proper to state why we arrange them under the two following heads:—

1. Diaphoretics, which cause a copious watery, cutaneous excretion, or flow of *sweat.*

2. Diaphoretics, which only augment the *ordinary perspiration.*

The first set excite the cutaneous capillaries and exhalents to a degree sufficient to increase both the secretory and the excretory functions of the skin beyond that point at which the perspired matter is carried off in the insensible form; thence it appears as sweat, and the substances inducing it ought to be distinguished from other diaphoretics. They are properly termed *sudorifics.* The second set operate in the same manner, but so moderately that they merely augment the ordinary insensible perspiration. It is true that both these results may be obtained by modifying the dose of the substances employed, and the circumstances under which they are administered; but nevertheless there are substances which, all circumstances being equal, produce a more powerful diaphoretic effect than others; and, therefore, this division is useful.

1. *Sweating* may be produced in two ways: by substances taken into the stomach; and by applications to the surface.

a. The substances capable of producing sweating when taken into the stomach—*sudorifics*—belong both to the *organic* and the *inorganic* kingdom of nature. Among the first, *ipecacuanha,* the root of the cephaelis *ipecacuanha,* which has been long known as a valuable sudorific, owes its properties to a peculiar alkaline principle, discovered by M. Pelletier, in 1817, named *emetia.*[*] Separate from the ipecacuanha, emetia has not yet been introduced into general practice in Great Britain, although it is much employed on the continent. Ipecacuanha in moderate doses, one grain or less, is well calculated to produce sudorific effects; but it is seldom administered alone for this purpose, being generally combined with opium, the narcotic influence of which it moderates, whilst its own diaphoretic powers are augmented by the combination. It exists in this state in the compound powder of ipecacuanha of the British Pharmacopœia, ten grains of which, a full dose for an adult, contain one grain of ipecacuanha and the same quantity of opium. In prescribing this powder, or ipecacuanha itself, or its infusion in wine, although it may be advantageously combined with camphor or with nitrate of potassa, yet it ought not to be prescribed in conjunction with astringent decoctions or infusions, as the tannin unites with the emetia, forming an insoluble tannate, which is inert. Its sudorific effects, when once begun, should be maintained by copious dilution with tepid fluids; but tepid drink should never be taken immediately after the powder, otherwise it may be rejected by vomiting. It should, also, be recollected that the diluents should not be acidulated, as the combination of vegetable acid with emetia is more likely to run off by the bowels than to exert a diaphoretic influence; at the same time, as it is advisable to add something to the tepid water to prevent the nausea extending to vomiting, lemon-peel may be infused in toast-water for that purpose.

Mezereon, the inner bark of the roots of daphne *mezereum,* is also supposed to owe its sudorific property to an alkaline principle, *daphnina,*[†] which was first procured by Vauquelin from the daphne *alpina;* but this is uncertain. Mezereon is a stimulant sudorific, exciting, powerfully, the heart and whole arterial system: it is apt to cause vomiting and purging. It has been found very useful in chronic rheumatism, and, in conjunction with the liquor arsenicalis, in obstinate cases of lepra, and some other chronic cutaneous affections. It is probably to its sudorific property that we are to ascribe its beneficial influence as an ingredient in the compound decoction of sarsaparilla, in secondary syphilis and many chronic diseases. We are aware that Mr. John Pearson states, that he had "very seldom found it possessed of medicinal virtue, either in syphilis or in the sequelæ of that disease, in scrofula or in cutaneous affections."* Our experience prevents us from according with this opinion. Its sudorific powers may be secured by administering an infusion, made with two drachms of the bark in a quart of hot water, in doses of f.℥ii. every four hours.

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[*] The emetia, in its separate state and pure, is white, pulverulent, and unalterable in the air, of a slightly bitter taste, inodorous, sparingly soluble in cold water, but soluble in hot water and in alcohol and ether. It is seldom obtained in this state, but is usually of a reddish-brown colour and deliquescent. One hundred grains of good ipecacuanha contain sixteen of emetia. MM. Magendie and Pelletier suppose that it is taken into the circulation, and exerts a specific effect on the lungs, and on the mucous membrane of the intestinal canal.

[†] Daphnina, when pure, is a colourless, inodorous alkaline salt, which crystallizes in transparent brilliant crystals, soluble in water, alcohol, and ether. The alkalies, lime water, and barytic water, tinge its solution of a golden hue; nitric acid converts it into oxalic acid.

Guaiacum, the concrete juice of the guaiacum *officinale*, was known as a diaphoretic so early as 1508, and was used by the natives of St. Domingo as a specific in syphilis; but although, when administered alone, it possesses no influence over lues venerea, yet it is a powerfully stimulant sudorific, and proves useful in impetigo and some other cutaneous eruptions; in ozœna, and in scrofulous affections of the membranes and ligaments. Its utility in these cases may depend on its power of augmenting the energy of the absorbents and the cutaneous capillaries, thereby improving the state of the cuticular function. In chronic rheumatism, a solution of guaiacum in aromatic spirit of ammonia, the tinctura guaiaci ammoniata, given in doses of from f.℥ss. to f.℥ii. at bed-time, and its sudorific powers aided in the morning by copious dilution with tepid fluids, has been productive of much benefit; and it is equally serviceable in atonic gout: but its boasted efficacy as a gout medicine has never been realised; and even in chronic rheumatism the remark of Dr. Ferriar, that although in some forms of the disease it proves serviceable, in others it produces no effect whatsoever, is no doubt correct. Dr. Chapman makes the following remarks on the efficacy of guaiacum in a morbid affection of the eye:—"There is a morbid affection of the eye of gastric origin, hitherto not sufficiently noticed, where, although no external inflammation exists, or so slightly as hardly to be perceived, there is great intolerance of light; sometimes very acute lancinating pains through the ball, although more generally the sensation is that of a dull obtuse ache, attended with much heat and aridity of surface, which, whatever may be its nature, is very successfully treated by the guaiacum." (Chapman's Materia Medica.) Dr. Chapman appeals to his own experience of the efficacy of this medicine, and affirms that he never saw the disease cured by any other—[yet the affection appears to be unknown to every other pathologist and therapeutist.]

As a sudorific, guaiacum acts freely only when the surface is kept warm; otherwise, it excites the urinary discharge. The more minutely the guaiacum is divided, the more certain is its sudorific power; and, therefore, the tincture, decomposed by water, if the precipitated guaiacum be rubbed up with mucilage to suspend it in the liquid vehicle whatever it may be, is the best form in which it can be prescribed. The dose of either of the tinctures is from f.℥ss. to f.℥iii. The ammoniated tincture is to be preferred in atonic gout.

It is unnecessary to enter into any details respecting those sudorifics which owe their powers to volatile oil. They are all too stimulant to be employed as sudorifics, except in diseases of diminished energy. In the low and sinking stage of typhus, serpentaria often proves beneficial; when, although the dry hot skin indicates the necessity of a sudorific, yet the nauseating and relaxing diaphoretics would prove injurious. It has also been found useful in dyspeptic affections accompanied with a dry skin, and is an excellent adjunct to cinchona or its salts in protracted cases of intermittents, and in atonic gout.

The only *inorganic* substances of value as sudorifics are the preparations of *antimony*. All of them may be so managed as to produce sudorific effects, but the most manageable and certain is the tartrate of antimony and potassa; and, in small doses, of from one-sixth to one-fourth of a grain, it seldom fails to procure copious sweating. The experiments of Dr. Elliotson have completely demonstrated the inert character of the pulvis antimonialis of the London Pharmacopœia; and the writer of this article has satisfied himself, by an experimental investigation, that it bears no resemblance to the true James's powder, the place of which it is intended to supply. The antimony in James's powder is in the state of a soluble *protoxide*; in the pulvis antimonialis it is usually† in that of an insoluble *peroxide*; and as it is undoubted that the more soluble the salts of antimony are, the more certain and powerful is their sudorific influence, it is easy to explain the general inefficacy of the antimonial powder, 130 grains of which have been given, three times a day, without producing even nausea. (London Medical Gazette, December 1831, p. 463.) But, at the same time, it must be admitted that no medicines are so much modified in their effects by idiosyncrasy as antimonials: in one person, small doses of tartar emetic will induce only moderate sweating; in another, the same dose will cause alarming vomiting and purging, extreme depression of bodily strength, and excite a degree of nausea which cannot be allayed.

The influence of antimonials is much augmented by combination with other substances, as camphor, calomel, and opium; but, in prescribing tartar emetic, it should be recollected that it is decomposed by alkaline carbonates, by the medicinal soluble salts of zinc, lead, bismuth, and mercury; and that an insoluble tannate is formed with the protoxide of antimony, when tartar emetic is added to any of the astringent vegetable infusions or decoctions, with the exception of those of oak-bark. The tannate thus formed is inert; on which account decoction of yellow cinchona is the antidote of tartar emetic. In acute rheumatism and other inflammatory affections, a combination of one grain of calomel, one-fourth of a grain of tartar emetic, and from one to two grains of opium, administered every fourth or fifth hour, produces everything that can be expected from a sudorific: indeed, when the intention is to determine powerfully to the surface, the tartrate of antimony and potassa, in small doses, repeated at proper intervals, and aided by warmth and diluents, is, as we have already said, more manageable and certain in its effects than any other of this order of remedial agents.

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* Pearson's Observations on the Effects of various Articles of the Materia Medica, in the cure of Lues Venerea, Lond. 1800, p. 49.

† We say usually, because no preparation used as a remedial agent is so variable in its nature. In a few specimens we have found a small proportion of the protoxide: but in far the greater number of the specimens examined, the antimonial is in the state of a peroxide.

b. Those agents which, applied to the surface, produce sweating by directly stimulating the cutaneous capillaries, are warm and hot baths, vapour-baths, hot air-baths, and the cold affusion. For the *modus operandi*, and manner of administering these, we must refer to the article Bathing.

2. The diaphoretics which merely augment the ordinary perspiration produce their effect in three ways:—1. through the medium of the stomach; 2. by entering the circulation, and acting directly on the skin; 3. by application to the surface.

Among the substances of this division of diaphoretics which operate through the medium of the stomach, we think it unnecessary to say anything either of *musk* or of *castor*. With respect to dulcamara, (the twigs of the solanum *dulcamara*,) which owes its efficacy to a peculiar alkaloid, named *solania*, either diaphoresis or diuresis may be produced by it, according to the extent of the dose or the manner in which the surface of the body is managed during its administration. It generally produces nausea, and not improbably much of its diaphoretic influence depends on this circumstance; and on this account the dose should be gradually increased during its administration. Two fluidounces of the decoction, made with ℥i. of the bruised twigs boiled in a pint and a half of water down to a pint, given three times a day, seldom fail to induce and maintain a gentle breathing perspiration. *Camphor* certainly produces a tendency to diaphoresis, without increasing the velocity of the pulse; and, therefore, it forms a useful adjunct to more decided diaphoretics; but with respect to sarsaparilla, even this is doubtful; and we are disposed to think that the diaphoresis which it is supposed to produce is due to the tepid diluent regimen which is generally prescribed during a course of it.

Among the inorganic substances belonging to this division of diaphoretics, we find the carbonate and citrate of ammonia, citrate of potassa, and acetate of ammonia. The first stimulates the nervous energy, and produces diaphoresis when aided by external warmth and plentiful tepid dilution; it is indicated in the sinking stage of typhoid fevers, and other debilitated conditions in which diaphoresis is still desired; but otherwise its place can be much better supplied by many other substances. In combination with guaiacum and opium, considerable advantage has been obtained from it in obstinate cases of chronic rheumatism. To produce its diaphoretic effect the dose should not be less than twelve grains, nor more than twenty: the best vehicle for administering it is the almond emulsion. The *citrate of ammonia*, which is generally prepared at the moment of its administration by saturating recent lemon-juice with carbonate of ammonia, possesses very moderate diaphoretic powers; but it is less nauseous than the acetate, and forms an excellent vehicle for tincture of opium, when it is desirable to promote its diaphoretic influence. The same remarks apply to the *citrate of potassa*, which is more frequently employed than the former preparation, especially when the stomach is in a highly irritable state. The old method of administering the saline draught—first swallowing the solution of the alkali, and immediately afterwards the lemon-juice, although now seldom recommended, yet had its advantages. The alkaline solution allays the irritability of the stomach, whilst the close application of the carbonic acid, extricated in the stomach, to the nerves of that viscus, affords a certain degree of tone without interfering with the diaphoretic operation of the neutral salt formed by the union of the two bases. The best of the neutral salts, however, for inducing diaphoresis is the *acetate of ammonia* in solution, the old spiritus Mindereri. The common solution of this salt, the liquor ammoniæ acetatis, is generally very carelessly prepared, and little pains taken to produce a strictly neutral solution: when the alkali predominates, the solution of tartar emetic, occasionally prescribed with it, is decomposed; when the vinegar is in excess, the usual dose of the antimonial excites vomiting. The crystallized salt, formed by saturating strong acetic acid with ammonia, being always neutral, should be employed in solution in preference to the usual preparation. When perfectly neutral, the solution is an excellent vehicle for soluble antimonials and opium, aiding considerably the effect of both on the skin; it is also easily retained on the stomach, and frequently allays the irritability of that organ when administered in doses of f.ʒiii. to f.ʒxii. in any bland fluid.

The last of the substances necessary to be noticed in this section of the second division of diaphoretics is *water*. The greater part of the fluid perspired by the skin is water; and if the surface be kept warm, so as to check the action of the kidneys, the proportion is generally in the ratio of the quantity of fluid taken into the stomach. But besides this cause of the diaphoretic influence of water, it is also well known that the sudden impression of a draught of cold water upon the nerves of the stomach acts most forcibly in promoting diaphoresis. A person who awakes in the night with the tongue feverish and parched, a quick pulse, and a dry, hot skin, finds immediate relief from swallowing a large draught of cold water: the cutaneous capillaries immediately consent with the stomach, and copious perspiration often ensues. By imitating this practice in fevers a similar result is occasionally obtained. When water is to be employed as a diaphoretic, much depends on the management of the patient during its administration. If the surface be kept warm, and the body surrounded with bad conductors of caloric, a moderate quantity of water will produce the effect required. Under these circumstances, cold water is to be preferred to warm; but it must be kept in remembrance that in delicate constitutions, even in fever when the excitement is high, a sudden reduction of temperature is hazardous, and, therefore, tepid drinks are necessary; and small quantities of aromatics may be added to the aqueous fluid to moderate the nausea which tepid water always produces.

Besides being diaphoretic itself, water is the general auxiliary of all other diaphoretics; nor can the influence of the best of them be maintained without ample dilution. In this case the fluid employed should always be tepid, at least of a temperature not under 65° Fahrenheit. The same rule, indeed, is necessary for the administration of diluents as for the external employment of water: when the temperature of the body is under 96°, cold drink should not be ordered. Nature points out the best indications for using water, both as to its administration at first and its continued employment, by the sensation of thirst which accompanies every state of febrile action: when this is present, we cannot err in prescribing water, the temperature being determined by that of the body and the state of the skin.

Among those substances which enter the circulation and operate as diaphoretics by their direct influence on the skin, the first which we have to notice is *sulphur*. When this substance is taken into the stomach, it passes off through the cutaneous exhalents united with hydrogen; a fact demonstrated by silver, worn in the pockets of those taking it, assuming the same dark hue as if it had been exposed to a stream of sulphuretted hydrogen gas; and as it thus passes off, it excites diaphoresis. As a diophoretic, sulphur is employed in cases of chronic rheumatism and some other skin diseases; and in combination with oil, the oleum sulphuratum of the London Pharmacopœia, in chronic catarrh: but this is an acrid, nauseous preparation, and consequently seldom administered. In combination with potassium, sulphur forms a solid preparation, hepar sulphuris, which by solution in water is converted into a hydro-sulphuret of potassa. Both of these preparations have been employed as diaphoretics in chronic affections of the chest, and in several cutaneous diseases.

The action of the salts of *mercury* upon the capillary system has been long known; and in having the cuticular discharge promoted by them, it is probable that the skin only shares, as a secreting organ, in the general influence which they exert on the glandular system; but although their influence on the cutaneous function is demonstrated by daily experience, yet they are only employed as auxiliaries in promoting diaphoresis. Calomel, the protochloride of mercury, is the preparation usually selected for obtaining the effect of mercury on the cuticular exhalents; and it is generally conjoined with tartar emetic or James's powder, ipecacuanha, guaiacum, or opium; to which it imparts additional sudorific power. In these combinations, calomel is given with advantage in all inflammatory diseases; and, in the form of Plummer's pill, in cutaneous eruptions and in chronic rheumatism. In this pill the antimonial is the antimonii sulphuretum præcipitatum of the London College, a preparation possessing more certain sudorific properties than the pulvis antimonialis: whether an influence can be ascribed to the guaiacum, considering its small proportion to the more active ingredients in this pill, seems doubtful. As a diaphoretic, the dose of calomel should not exceed one grain, frequently repeated.

c. Whether sweating or mere diaphoresis be produced, the cause of both, as far as they are the result of the substances to which we have already referred, is the augmented action of the whole vascular system; but diaphoresis may be procured by the excitement merely of the cutaneous capillaries. The natural insensible perspiration is, indeed, apparently the effect solely of the cuticular system of vessels; and although means exist by which this may be carried to sweating, yet still the cause is confined solely to the cuticular vessels. *Friction* operates in this way, acting on the surface, in a manner equivalent to muscular exertion on the whole habit, in augmenting diaphoresis. The *tepid bath* produces its effects on the same principle, although both the degree and the nature of the stimulus be different. When the tepid bath is employed, it is necessary to continue the application for a considerable time to produce the desired effect. The first result of its application is emollient, the second diaphoretic.

In remarking on the practical employment of diaphoretics, we should say that they must be selected according to the nature of the disease, and the object to be accomplished. Those that operate by augmenting the force of the general circulation are well adapted for relieving internal congestions; those which produce nausea and unload the oppressed capillaries, are adapted for diminishing febrile action, and reducing the morbid temperature of the body.

With respect to the diseases in which diaphoretics are beneficial, we must refer to the various articles which are devoted to their consideration.

[It may, however, be doubted whether we have any internal remedies that are capable of acting as direct diaphoretics,—that is, by virtue of specific properties which they possess over the glandular or diapnogenous apparatus of the skin. In every case in which the skin is hot and dry, and the indication appears to be to establish diaphoresis, the cause of this condition of the cutaneous exhalents must be inquired into, and if possible removed. Hence it is, that the well-instructed practitioner employs *indirect* diaphoretics rather than such as are esteemed *direct*. Thus, diminished sensible exhalation takes place from the skin during the existence of fever or inflammation, but the physician does not have recourse to any reputed diaphoretic, which acts by exciting the sanguiferous system. He adapts his antiphlogistic remedies so as to reduce the already too much excited condition of the blood-vessels, to the healthy standard; and he finds, when he has removed the internal inflammation, the heat and dryness of the skin subside, and diaphoresis satisfactorily established. Under similar circumstances, a full dose of opium is attended with a similar result. Opium in a full dose is a sedative; and hence morphia, in large doses, is often so powerfully diaphoretic. Nauseants are most effective diaphoretics in diseases of excitement; and they are powerful sedatives. On the whole, even in febrile and inflammatory affections, the use of the ordinary internal diaphoretics is uncertain, and generally of no avail; and many of them are de-is the antidote of tartar emetic. In acute rheumatism and other inflammatory affections, a combination of one grain of calomel, one-fourth of a grain of tartar emetic, and from one to two grains of opium, administered every fourth or fifth hour, produces everything that can be expected from a sudorific: indeed, when the intention is to determine powerfully to the surface, the tartrate of antimony and potassa, in small doses, repeated at proper intervals, and aided by warmth and diluents, is, as we have already said, more manageable and certain in its effects than any other of this order of remedial agents.

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Besides being diaphoretic itself, water is the general auxiliary of all other diaphoretics; nor can the influence of the best of them be maintained without ample dilution. In this case the fluid employed should always be tepid, at least of a temperature not under 65° Fahrenheit. The same rule, indeed, is necessary for the administration of diluents as for the external employment of water; when the temperature of the body is under 96°, cold drink should not be ordered. Nature points out the best indications for using water, both as to its administration at first and its continued employment, by the sensation of thirst which accompanies every state of febrile action: when this is present, we cannot err in prescribing water, the temperature being determined by that of the body and the state of the skin.

Among those substances which enter the circulation and operate as diaphoretics by their direct influence on the skin, the first which we have to notice is *sulphur*. When this substance is taken into the stomach, it passes off through the cutaneous exhalents united with hydrogen; a fact demonstrated by silver, worn in the pockets of those taking it, assuming the same dark hue as if it had been exposed to a stream of sulphuretted hydrogen gas; and as it thus passes off, it excites diaphoresis. As a diophoretic, sulphur is employed in cases of chronic rheumatism and some other skin diseases; and in combination with oil, the oleum sulphuratum of the London Pharmacopœia, in chronic catarrh: but this is an acrid, nauseous preparation, and consequently seldom administered. In combination with potassium, sulphur forms a solid preparation, hepar sulphuris, which by solution in water is converted into a hydro-sulphuret of potassa. Both of these preparations have been employed as diaphoretics in chronic affections of the chest, and in several cutaneous diseases.

The action of the salts of *mercury* upon the capillary system has been long known; and in having the cuticular discharge promoted by them, it is probable that the skin only shares, as a secreting organ, in the general influence which they exert on the glandular system: but although their influence on the cutaneous function is demonstrated by daily experience, yet they are only employed as auxiliaries in promoting diaphoresis. Calomel, the protochloride of mercury, is the preparation usually selected for obtaining the effect of mercury on the cuticular exhalents; and it is generally conjoined with tartar emetic or James's powder, ipecacuanha, guaiacum, or opium; to which it imparts additional sudorific power. In these combinations, calomel is given with advantage in all inflammatory diseases; and, in the form of Plummer's pill, in cutaneous eruptions and in chronic rheumatism. In this pill the antimonial is the antimonii sulphuretum præcipitatum of the London College, a preparation possessing more certain sudorific properties than the pulvis antimonialis: whether an influence can be ascribed to the guaiacum, considering its small proportion to the more active ingredients in this pill, seems doubtful. As a diaphoretic, the dose of calomel should not exceed one grain, frequently repeated.

c. Whether sweating or mere diaphoresis be produced, the cause of both, as far as they are the result of the substances to which we have already referred, is the augmented action of the whole vascular system; but diaphoresis may be procured by the excitement merely of the cutaneous capillaries. The natural insensible perspiration is, indeed, apparently the effect solely of the cuticular system of vessels; and although means exist by which this may be carried to sweating, yet still the cause is confined solely to the cuticular vessels. *Friction* operates in this way, acting on the surface, in a manner equivalent to muscular exertion on the whole habit, in augmenting diaphoresis. The *tepid bath* produces its effects on the same principle, although both the degree and the nature of the stimulus be different. When the tepid bath is employed, it is necessary to continue the application for a considerable time to produce the desired effect. The first result of its application is emollient, the second diaphoretic.

In remarking on the practical employment of diaphoretics, we should say that they must be selected according to the nature of the disease, and the object to be accomplished. Those that operate by augmenting the force of the general circulation are well adapted for relieving internal congestions; those which produce nausea and unload the oppressed capillaries, are adapted for diminishing febrile action, and reducing the morbid temperature of the body.

With respect to the diseases in which diaphoretics are beneficial, we must refer to the various articles which are devoted to their consideration.

[It may, however, be doubted whether we have any internal remedies that are capable of acting as direct diaphoretics,—that is, by virtue of specific properties which they possess over the glandular or diapnogenous apparatus of the skin. In every case in which the skin is hot and dry, and the indication appears to be to establish diaphoresis, the cause of this condition of the cutaneous exhalents must be inquired into, and if possible removed. Hence it is, that the well-instructed practitioner employs *indirect* diaphoretics rather than such as are esteemed *direct*. Thus, diminished sensible exhalation takes place from the skin during the existence of fever or inflammation, but the physician does not have recourse to any reputed diaphoretic, which acts by exciting the sanguiferous system. He adapts his antiphlogistic remedies so as to reduce the already too much excited condition of the blood-vessels, to the healthy standard; and he finds, when he has removed the internal inflammation, the heat and dryness of the skin subside, and diaphoresis satisfactorily established. Under similar circumstances, a full dose of opium is attended with a similar result. Opium in a full dose is a sedative; and hence morphia, in large doses, is often so powerfully diaphoretic. Nauseants are most effective diaphoretics in diseases of excitement; and they are powerful sedatives. On the whole, even in febrile and inflammatory affections, the use of the ordinary internal diaphoretics is uncertain, and generally of no avail; and many of them are decidedly injurious by their excitant properties; yet, in many such cases, advantage may be derived from the equalizing influence of the warm-bath; and in minor inflammations, especially of the gastro-pulmonary mucous membrane,—as catarrh,—warm diluents, aided by the warmth and quietude of bed, produce an equalizing effect, which is often most salutary.

In almost all cases in which the employment of diaphoretics appears to be indicated, the class of sedatives, (*q. v.*) or refrigerants, (*q. v.*) or both, will be found infinitely more advantageous. (*General Therapeutics*, &c., i. 312.)]

A. T. Thomson.

DIARRHŒA, (Διάῤῥοια, from διαῤῥέω, *perfluo*, primarily from διά, *per*, and ῥέω, *fluo*); looseness, flux, lax. This is a very common and well-known disease, characterised by frequent and imperative calls to go to stool, the evacuations being more liquid than the usual healthy discharges from the bowels. Pain or griping is occasionally an attendant, but not necessarily so. This disorder is frequently a matter of trifling importance; at other times it is productive of serious consequences.

Causes.—Diarrhœa may originate in very various causes. One of the most common is the direct application of stimulants to the interior of the digestive tube. Errors in diet, either in quantity or quality, will often act in this way. When a great mixture of different kinds of food and drink is taken at the same meal, a sudden attack of diarrhœa is no uncommon occurrence, and need not be matter of surprise. In some constitutions a draught of cold water, beer, milk, &c. immediately affects the bowels, especially if the individual is heated at the time; and ices are often productive of the same effect. Unwholesome articles of diet operate in a similar manner on many individuals. Of this kind are, animal food approaching to a putrid state, raw vegetables, cucumbers, melons, mushrooms, certain salads, &c.* Diarrhœa is also a very common occurrence in infants when the nurse's milk disagrees, or when other food is given too stimulant for their digestive powers, or in too great quantity.

Diarrhœa occurs as a sympathetic disorder in many diseases, as in the dentition of children; and there are many affections of a more general kind where it is a frequent attendant. Measles, scarlatina, and other exanthemata, afford examples of this. In such cases there is little doubt that an excited or hyperæmic state of the mucous membrane takes place: some have even supposed that an eruption analogous to that on the surface may be present. In gastric and enteric fevers, also, diarrhœa is a frequent symptom. It is often the initiatory state in cholera and dysentery; and in some diseases, as fevers, it occasionally shows itself as a critical discharge. The diarrhœa which attends the latter stages of phthisis, and other forms of hectic and atrophic affections, is universally known.

Many causes give rise to diarrhœa in a less direct manner, such as exposure to cold, cold and wet feet, an atmosphere simply cold and damp, or impregnated with putrid exhalations, &c. With some persons exposure to warm and damp air is productive of the same consequences; and alternations of temperature are often equally effective, as in the case of a hot day being succeeded by a chilly evening. Suppressed evacuations, as interrupted sweat, checked menstruation, the disappearance of abscesses, retrocession of the eruption of smallpox, measles, or scarlatina, are occasionally succeeded by diarrhœa. Many persons of a nervous temperament are subject to similar attacks on the least agitation of mind, anxiety, or surprise; and when such mental states are present, the slightest errors of diet will be followed by liquid discharges from the bowels, although the same persons are exempt from any such attacks when no such disturbing causes are in operation, even when they indulge in a great variety of food. Morbid secretions from the liver and other glands that open into the intestinal canal, as well as irritating secretions from the mucous membrane itself, are also causes of diarrhœa. So likewise are worms generated there; but less frequently than might be expected.

Gout in many instances appears to maintain a tendency to loose discharges from the bowels, and to expend itself by this outlet. We have known several cases of persons who were accustomed to have three or four loose motions daily while in health; and when the least interruption to this ordinary habit took place, a fit of regular gout came on, the diarrhœa re-appearing when the gouty attack had subsided. One gentleman had his first attack of gout on giving a check to a loose state of the bowels which he considered troublesome; and for many years afterwards diarrhœa and gout constantly alternated. This is the *diarrhœa arthritica* of Sauvages, and is noticed by many practical writers, as Sydenham, Baglivi, Musgrave, &c. Many persons are liable to diarrhœa on visiting certain cities, as London, Paris, Cork, Limerick, Galway, &c. The waters of such places are commonly accused as producing the complaint, but there are probably other causes. Diarrhœa often prevails epidemically without our being able to trace the precise cause; but in such cases it is commonly accompanied by catarrhal affections of other mucous membranes.

Symptoms and different forms of Diarrhœa.—An attack of diarrhœa is, in most instances, from whatever cause it may proceed, preceded by feelings of indigestion, nausea, flatulence, &c. It is usually attended by more or less pain or uneasiness in different parts of the abdomen, more especially before the bowels are called upon to act. In the more severe forms, the abdomen is often swelled, hot, and painful to the touch, and the discharges are announced by searching pains of various degrees, sometimes slight, sometimes very severe, and attended occasionally by fainting, and frequently by nausea, or even vomiting. The pain seems to follow the transit of the alimentary mass, and to be connected with the peristaltic contractions of the muscular coat of the intestines.

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* We have the personal testimony of no less a man than Cicero, that the substances last mentioned are productive of this complaint — Dum volunt isti lauti terra nata, quæ lege excepta sunt, in honorem adducere, fungos, helvellas, herbas omnes ita condiunt, ut nihil possit esse suavius. In eas quum incidissem in cœna augurali apud Lentulum, tanta me διάῤῥοια arripuit, ut hodie primum videar consistere. Ita ego, qui me ostreis et murenis facile abstinebam, a beta etiam et a malva deceptus sum.—Epist. Fam. lib. vii. 127.

The discharges take place without effort, and in some instances are involuntary. The patient feels weaker after each evacuation, yet experiences some relief from the pain, tension, and flatulent working in the bowels.

The number of stools is very uncertain; they may amount to ten, fifteen, twenty, or even twice that number, in the twenty-four hours. In the commencement of the attack they are abundant in quantity; afterwards they become more scanty, and, whatever may have been their original condition, consist chiefly of a serous fluid mixed with fibrous threads. The discharges are more fœtid in proportion to the quantity of proper excrementitious matter contained in them. Paleness and wasting of the body accompany the severer attacks; likewise a sense of chilliness, dry skin, a loaded tongue, and a diminution of the urinary secretion. The patient becomes often so enfeebled as to be forced to keep his room or even his bed.

The nature of the evacuations in diarrhœa has of course attracted the attention of physicians in a very particular manner, and in most cases they have been considered as constituting the very essence of the disease. The discharges vary extremely in colour, consistence, and other physical characters; and although this variety is often observable in individual cases, either at one and the same instant, or at different periods of the attack, still, generally speaking, different cases commonly preserve throughout their course one predominant character of the evacuations. On this fact has been founded the most common classification of diarrhœa which we possess, and which, variously modified, has obtained from the earliest times up to the present period. This classification is, no doubt, as we have just observed, founded in nature; still it must be strongly impressed on the mind of the student and young practitioner, that the nature of the stools alone cannot be admitted as affording a true indication of the pathological condition of the parts which constitute the seat of the disease, and much less as a guide in practice. Constant attention to their character, however, can never be dispensed with on the part of the practitioner.

For a full account of all the appearances of the discharges which have been considered as characterising different species or varieties of diarrhœa, we must refer to nosologists and systematic writers. We can only notice a few of the most remarkable.

Feculent diarrhœa. — The evacuations in this variety are of the ordinary fæcal character, but more liquid and more frequent than natural. This may be said to be present in the commencement of all the other forms, inasmuch as the fæcal contents of the bowels must be evacuated either before the morbid secretions take place, or in conjunction with them. What, however, has been usually termed feculent diarrhœa, is that in which the evacuations retain this character through the greater part of their course. This is the *D. stercorea* of Sauvages, the *D. crapulosa* of Cullen, and the *D. fusa* of Good. It is apt to occur to those who have large appetites, and who have overloaded the stomach with a variety of food. It often comes on without warning and without pain. It is sometimes attended with dyspeptic symptoms, but sometimes not. It generally ceases of its own accord; and though it leaves the patient somewhat debilitated, the healthy functions of the bowels are soon restored, provided the patient or his attendants are not too anxious prematurely to arrest the discharges, or again to overload the stomach with improper food.

Bilious diarrhœa.—This is not a very uncommon form of bowel disorder, yet we believe it is often said to be present when the affection is merely that last described. In the proper bilious diarrhœa, the stools, at first fæcal, are loaded with a morbid proportion of bile, and are, in consequence, of a bright yellow or greenish colour. It is supposed to arise from an excited condition of the liver producing a superabundant secretion of bile, or bile of a morbid character, which acts on the mucous membrane of the bowels as a stimulant. This state of the liver is frequently produced, we believe, by a primary affection of the duodenum, of an inflammatory kind, which either simply excites the gland to increased action, by what has been termed continuous sympathy, or produces in it a like condition with itself. In either case the result is an augmented flow, and probably a depraved state of the bile. This species of diarrhœa is often met with in those who live intemperately, or whose hepatic organs have suffered in warm climates. Intense moral emotions, such as a violent fit of anger in sanguine temperaments, or grief and disappointment in melancholics, have been observed to give rise suddenly to it. The connection between the manifestation of the passions of the mind and the secretion of bile, so familiar to our classical readers in the writings of the ancient physicians as well as poets, is founded in accurate observation, and no doubt originated in the supervention of the form of diarrhœa now under consideration, to strong mental emotions. All our nosologists agree in terming this variety *D. biliosa.*

Mucous diarrhœa.—In the true mucous diarrhœa, the stools contain little or no proper fæcal matter, but consist chiefly of mucous or watery fluids, the former being predominant. The stools sometimes consist entirely of mucus, which is passed either in large continuous masses, or in separate flakes, intermixed with more liquid matters; it is often found, particularly in the commencement of an acute attack, or rather, after this has lasted a few days, quite transparent, and of the consistence of jelly; at other times it lies at the bottom of the pan like semi-transparent mucilage. The stools are of very various colours, depending chiefly on the degree of admixture with bile, but the characteristic features of the variety are to be sought for rather in the consistence and tenacity than in the colour. This form of diarrhœa is usually acute, and often reigns epidemically in conjunction with mucous fevers and catarrhal affections of the other mucous membranes, with some of which it occasionally alternates. It is often unaccompanied with fever, even when of considerable severity; sometimes, however, there is a very marked febrile state. It sometimes assumes a more chronic or sluggish course in old delicate valetudinarians, who suffer from dyspeptic, hypochondriac, and other chronic ailments. In such cases, both the stomach and bowels are often loaded with depraved mucus secreted in great quantity, and which appears to be the cause of the diarrhœa. In cases of this kind the mucous membrane is sometimes found thickened and congested, and the mucous follicles are erected and patulous; and unless a suitable treatment is adopted, the disease degenerates into a permanently chronic state, probably with atrophy or dropsy. This is the *D. mucosa* of Cullen and Good, the *Cœliaca mucosa* of Sauvages.

Serous diarrhœa.—In this form the discharges are quite serous or watery, and hence it has been termed *diarrhœa aquosa* by many authors. The stools may be coloured variously, or they may be nearly colourless; they may be almost limpid or intermixed with minute flakes or shreds. Sometimes they are intermixed with mucus, but their characteristic feature is their being copious and watery. In some cases the quantity of fluid passed is very great, and speedily induces extreme debility. It is not always easy to distinguish this variety from cholera.

Serous diarrhœa may be produced under the same circumstances as the mucous variety, and then it must be considered as an acute disease, and as being, in many cases at least, dependent on an excited or inflamed state of the mucous membrane of the bowels. At other times it would appear as if the serous discharge originated in an opposite condition of this part, the exhalents pouring out their contents rather from loss of tone, and passively, than by an active organic process. It sometimes succeeds profuse perspirations suddenly repressed, or the imprudent use of acids and cold drinks when the body has been heated. It is sometimes the mode in which nature relieves herself from other diseases, as in dropsy, which has been known entirely to disappear on the supervention of a profuse diarrhœa of this kind. In very severe cases the discharges are so copious, and the emaciation and exhaustion so great, that it would appear as if almost the entire contents of the exhalent system were thrown upon the intestines. A marked form of this species is the diarrhœa of infants, termed *watery gripes*, in which the stools are often purely serous. This is the *D. serosa* of Sauvages and Good: it is included under the last variety (mucosa) by Dr. Cullen.

There is a variety of diarrhœa termed *tubularis* by Dr. Good, and which may be more properly named flaky or membranaceous. It is more entitled to notice as throwing some light on the pathology of the disease than as a distinct species of diarrhœa. In this variety there is a discharge of coagulable lymph, generally in the form of shreds or bands of more or less extent, and sometimes retaining the tubular shape of the bowel, whence Dr. Good derived his specific epithet. Such discharges are certainly met with in relaxed states of the bowels, but they are still more generally, perhaps, observed in cases where constipation is the habitual state. The fact is, that the peculiar inflammation of the mucous membrane, which gives rise to this morbid secretion, may produce either constipation or diarrhœa; and it is probable that when the former state exists, the seat of the disease is in the small intestines, and when the latter, in the large intestines. We have frequently observed these fibrinous discharges in cases of temporary diarrhœa supervening to a long-continued state of constipation, whether excited by improper diet, purgative medicines, or occurring without any obvious cause. Such cases are, in fact, examples of chronic enteritis, and not of diarrhœa.

The *chylous* or *milky* diarrhœa of authors, and that termed *gypseous* or *chalky* by Dr. Good, are both denominated from false notions of their nature. We believe that the whiteness in the one case is no more owing to the presence of chyle, than in the other it is produced by lime, as Dr. Good supposed. The chief cause of the white colour in both these varieties is, no doubt, the absence of bile of the natural character or quantity; but as this may occur in very different states, and when the discharges are in other respects very different, there is no sufficient reason for establishing any distinct form of disease on these grounds. It is proper to observe, however, that in chronic cases when the stools are of this colour, and more particularly if they resemble an admixture of chalk and water, as described by Dr. Baillie (Med. Trans. vol. v.), they for the most part indicate a disease of a serious, often of a dangerous character.

The variety termed *lientery*, in which undigested aliment appears in the stools, has no claim to be considered as a distinct form of diarrhœa, as the circumstance supposed to characterise it may occur in every species of the complaint.

Nature of the Disease.—The foregoing account of the principal phenomena and more marked varieties of diarrhœa has necessarily anticipated much that might be said under this head. We shall therefore content ourselves with a few additional observations. "It is with difficulty," says Dr. Cullen, "that I have arranged this genus, as it is not very consistent with our plan to let it stand in our nosology. Diarrhœa is universally symptomatic of a great variety of diseases, many of which are different from one another; so that a genus formed from all these is a very complicated one, and comprehends many dissimilar affections and diseases." (First Lines, Dr. Thomson's edition, vol. ii. p. 470.) This observation of Dr. Cullen is very just; but he might have gone even further, and stated that in a perfectly philosophical system of medicine, what is commonly termed diarrhœa would be regarded merely as a symptom of different pathological states, and would, therefore, be banished from the list of individual diseases. We are, however, far from having attained to this perfection of pathology even in theory; and it is more than questionable if the adoption of such a view of the case in practice would ever be beneficial. The safer plan to follow is to consider *the flux*, termed diarrhœa, as a distinct disease, but to regard it as the consequence of various morbid states in different cases; the practitioner only taking care, before he applies his remedies, to ascertain the particular state which exists in the individual case before him, as far as his observation and pathological knowledge enable him to do so. If he does not do this, but regards *the flux* only, without reference to its cause, he will be liable to commit grievous errors in his treatment.

As a general rule, we may consider diarrhœa as having its seat in the intestinal mucous membrane; and it is the state of this membrane, and not the discharge, which is to be regarded as the great object of attention to the pathologist and practitioner. The only exceptions to this rule are the cases where the disease is excited by fluids poured into the intestinal tube from the annexed glands, or by irritants of a temporary kind, as food or medicines, applied directly to the membrane. Even in these cases the secondary affection of the membrane is often of much more importance than the cause producing it.

In the class of cases just mentioned, the mucous membrane of the bowels can scarcely be said to be diseased; and the functional disturbance speedily subsides on the removal of the offending cause. But in the great majority of the cases of diarrhœa the membrane is affected in a more permanent manner, although the degree of this varies extremely.

In the mildest form of the affection there seems to exist merely a morbid degree of irritability, or a morbid sensibility, in the mucous membrane, which scarcely exhibits any indication of disease, except when excited by something applied to it. What, however, in a sound state would produce only the proper and natural degree of peristaltic action, now produces a morbid degree of action incompatible with perfect health. In another form of the affection there exists, perhaps in conjunction with the foregoing state, a morbid degree of excitement or of increased action in the membrane, considered as a secreting and exhaling organ, whereby it throws out its fluids in a morbid state or in a morbid quantity, or both. In a third class of cases it is supposed by some that the exhalents, in place of being excited to increased action, are in a state of atonic relaxation, and thereby allow their fluids to escape in a condition no less deviating from that of health.

But in a still more numerous class of cases there exists a more permanent deviation from the healthy condition of the mucous membrane, namely, some form or degree of that pathological state to which we give the name of inflammation. In diarrhœa this state may exist in every degree, from the slightest shade of congestive irritation up to well-defined alteration of the normal structure of the membrane: it may be confined to a small portion of the intestinal tube, or it may extend over a large portion. In this form of diarrhœa, the evacuations deviate greatly from the character of health, and consist principally of fluids secreted by the inflamed membrane, being mucous or serous, or flaky from admixture of coagulable lymph, and very variously coloured according to the condition of the liver, the ingestion of food, the previous treatment, &c. In almost all cases the inflammation is confined to the large intestines; but in some it extends to the small, and it may even originate there.

The form of diarrhœa just noticed, and which may almost always be regarded as present in recent cases of much severity, and in which the stools are not fæcal, can be considered as differing from the disease termed dysentery only in degree. When the inflammation is strongly marked, no doubt there supervene some peculiar symptoms—particularly the intermixture of blood with the mucous discharges, and fever—which do not exist in diarrhœa; but still the essence of both diseases is the same. Both are inflammations of the mucous membrane of the large intestines; but in the one the affection is slight, in the other it is severe. There is the same difference between them as there is between a mild pulmonary catarrh and bronchitis, but no more.

The diarrhœa which almost always attends the latter stage of phthisis depends on ulceration of the mucous membrane. The ulcers in this case are often extremely numerous, being spread over the whole extent of the bowels, but they are most common near the extremity of the ileum. Many other organic affections of the mucous membrane of the bowels, for the most part the consequence of inflammation, give rise to diarrhœa; but cases of this kind do not come properly within the scope of the present article.

The state of the mucous membrane found on dissection in simple diarrhœa, varies greatly in different cases. In recent examples, not connected with other diseases, opportunities for examination after death will rarely occur, as almost all such cases are cured. When opportunities of examination have been found, the membrane, in recent cases, has been observed more or less red and congested, or extremely pale and anæmic, the redness being disposed in patches or in continuous stripes, leaving the intervening portions very pale. In cases of more severity and long standing, although still short of the degree constituting the dysentery of nosologists, a great variety of morbid appearances have been found. In these the membrane presents every variety of colour, from the most intense red, purple, or brown, to the blanched or anæmic state above mentioned, in which there is nothing to be seen in the vessels but colourless fluids. In other cases there is an enlarged and patulous condition of the mouths of the mucous follicles, which look erected, and sometimes inflamed, and as if excoriated. The whole mucous membrane is also found thickened and œdematous, as in certain forms of dropsy, and is often greatly softened. The intestinal tube is frequently much contracted in its caliber. In some cases coagulable lymph is found adherent to the inflamed spots; but this is not of frequent occurrence: very tenacious mucus of an inspissated character is common. In many instances dissection detects scarcely any deviation from the state of health; and then we may reasonably suppose that the exhalents and mucous glands merely afford a rapidly increased supply.

The termination of diarrhœa, when unattended by other, and especially visceral diseases, is for the most part favourable. But when the inflammatory state of the membrane becomes considerable, the disease then, under the name of dysentery, may lead to very serious results, ulceration taking place in the different tissues of the intestine, sometimes followed by perforation and fatal peritonitis. In some cases the inflammation of the mucous membrane extends or is transferred to the serous coat, giving rise to ascites. In this way diarrhœa and dropsy have been observed to alternate, according as the morbid action chiefly occupied the internal or external tunic of the bowel. When it assumes the chronic form, diarrhœa is sometimes a most obstinate disease, resisting in many cases, for months or years, every variety of treatment. When, however, it is not immediately dependent on great organic changes in the bowels or connected viscera, the general health is often much less affected, even in severe cases, than might be expected. We have known chronic diarrhœas of considerable severity continue through the greater part of a long life.

Treatment.—In undertaking the cure of a case of diarrhœa, it is often of as much consequence to consider its degree of severity and its duration as its precise nature. Slight cases of every kind are in general easily removed; and in recent cases, even when severe, the mode of treatment is almost always simple, and generally successful.

Acute or recent diarrhœa.—1. in the common form of feculent diarrhœa recently produced by some known cause of irritation, as from improper food or otherwise, it is seldom that any other treatment is necessary except abstinence from food, with rest, and simple dilution. In such cases the offending matter is commonly itself speedily evacuated, and occasions at the same time a complete discharge of the whole fæcal contents of the bowels. When this is effected, the morbid action usually subsides of its own accord, and health is at once restored. Sometimes, however, the offending matter is either not thrown off, or only partially, and a degree of excitement is kept up sufficient to irritate the bowels without unloading them; the stools, partly fæcal, partly mucous or serous, are scanty, and are accompanied with more or less of griping. The indication here evidently is to unload the bowels thoroughly; and it is best fulfilled by an active but not irritating purge, such as castor oil, rhubarb and magnesia, or the common senna draught of a moderate degree of strength. When the evacuations are free and complete, the irritation is commonly at an end. But sometimes, in place of being insufficient, the evacuations are too copious; the irritating matter has acted like a drastic purge; or the ineffectual efforts produced by the primary cause have been raised beyond the healthy degree by the purgative, and the same result of hypercatharsis ensues. In cases of this kind the obvious and appropriate remedy is an opiate; and few cases will resist the effect of this when combined with quiet, a warm bed, and abstinence.

In feculent diarrhœa coming on without any very obvious exciting cause, in persons who are great eaters, or whose bowels are generally in a confined state, it will likewise be proper in most cases to administer a purgative, as the probability is that the cause of the diarrhœa is some irritating matter lodged in the bowels, and not any primary source of irritation in the intestinal membranes; and it may be stated, as a general rule, that in recent cases, if the motions are fœcal, this practice will always be safe, and generally beneficial. Even in cases where the stools are altogether without proper fæces,—mucous or serous,—if there exist any reason to expect an accumulation of fæces in the bowels, a purgative will still be proper. The previous health of the patient, his habits as to eating and alvine exoneration, the nature of the stools at the very commencement of the attack, and the degree of tension and hardness of the bowels, will, if duly weighed, in most cases lead to a just conclusion as to the point in question. Where there remains any doubt, the safest plan will be to give a moderate dose of a mild purgative, particularly castor oil, and be guided by its effects. If by its operation fæcal stools are brought away, and the irritation still continues, a repetition of the dose or a still more active form of medicine will be proper. In persons whose bowels have been costive for some time before the attack, and also in those who are large feeders, and particularly if they lead sedentary lives, a dose of colocynth with calomel and antimonial powder may be proper, followed up after a few hours by the saline senna draught; the after treatment being the same as before.

2. If the feculent diarrhœa is complicated or caused by a superabundant secretion of bile, it will be necessary to restore the liver as well as the bowels to its healthy functions. The unloading the bowels by purgatives may be at first necessary; but when this is effected, the treatment of the hepatic affection may be a work of some time. It is obvious that the consideration of this subject belongs rather to another place, (see HEPATITIS, and LIVER, DISEASES OF); but we may be allowed to say a few words on it in reference to diarrhœa. If the augmented flow of bile or its depravation has been produced by a mere temporary excitement, little specific treatment will be requisite, as the disorder of function will in most cases be removed on the removal of the cause. What is more commonly called bilious diarrhœa is, however, in general, an affection of a more fixed character, depending, as we had occasion formerly to remark, either on an inflammatory state of the liver itself, or an excited condition of this gland transmitted through its ducts from an inflamed duodenum. In both cases the disease is usually of an acute character, and requires nearly the same treatment. If the inflammatory state is considerable, or is attended with fever, venesection will be proper; but this will not often be the case in any state which can be classed under the head of diarrhœa. Local bleeding with leeches, or cupping in the hepatic and præcordial region, will, however, always be proper, and must be carried to such an extent as the urgency of the symptoms may seem to require. The repetition of this measure several times, after the interval of one or two days, may be requisite; and its effects will be greatly promoted by the frequent use of warm fomentations to the same parts. Mild mercurial preparations, the best of which is the hydrargyrum cum cretâ, will also be proper in cases of this kind, more especially if the affection of the liver is primary; they should be given in small doses at bed-time, and followed up next morning by a moderate dose of castor oil or other mild purgatives; but care must be taken that the inflammatory condition of the duodenum (if it exist) be removed, or at least mitigated by other means, before the administration of purgatives. Calomel will then have a much more beneficial effect in restoring the healthy condition of the liver. Cooling, saline, and demulcent ptisans constitute the best general remedies in this kind of diarrhœa, and commonly suffice, in conjunction with the means above mentioned and a proper

diet, to restore the patient to health. The proper diet in these and other cases will be mentioned hereafter.

3. In the acute or recent diarrhœa, distinguished by the discharges being chiefly mucous or serous, with little or no admixture of proper fæces, all these having been previously evacuated either by the natural efforts or by purgatives administered with this intent, we are no longer to look for relief from the employment of cathartics, but from means calculated to allay the irritation which exists in the mucous membrane, and which constitutes the disease. These means consist of a proper diet, or the abstinence from all food, the internal use of refrigerants, diluents, demulcents, diaphoretics, and opiates, the local detraction of blood, warm baths or fomentations, and other measures of analogous tendency. The treatment will vary considerably according as the attack is slight or severe, and also according to the nature of the exciting cause. In very mild cases, keeping the patient in bed, and restraining him from the use of all kinds of food, with the exception of barley-water,—in small quantities, and this only if there is thirst,—will very often put an end to the attack in twenty-four hours, without any other means. If the attack appears to have originated in cold or obstructed perspiration, it will be proper to apply the general means found most useful in catarrhal affections, of which the most effective are confinement to bed, in a warm room, and mild saline diaphoretics. If the case is somewhat more severe, the application of warm fomentations to the abdomen, by means of flannel bags filled with bran and dipped in hot water, will be proper, (they will indeed be proper, though perhaps not absolutely necessary, in the very mildest cases,) together with small doses of mucilage, with or without nitre or the liquor ammoniæ acetatis, and an equally rigid system of diet. If the diarrhœa does not speedily yield to these mild measures, or if it be accompanied with much griping or painful tenesmus, a small dose or two of laudanum, or of the pulv. ipec. comp. in chalk mixture, will be proper; or a glyster may be administered, consisting of not more than a couple of ounces of starch mucilage, and a proportion of opium varying according to the severity of the case.

When irritation is not very considerable, these means will almost invariably put an end to the attack in a very short time. But should they not do so, or should the severity of the symptoms at the commencement announce the invasion of a more formidable disease, previously to the use of opiates, six, eight, ten, or twelve leeches, according to the violence of the attack, should be applied to the anus, and the glyster be afterwards given. The leeches may be applied a second or even a third time, if the complaint proves obstinate. In some cases general bloodletting may be proper; but this is a measure rarely necessary while the disease remains of such moderate severity as still to justify the application to it of the term diarrhœa.

The internal remedies we are accustomed to employ in the cases where opiates are improper or unnecessary, or in conjunction with these, consist almost entirely of the blandest fluids given in small quantities, such as the mucilage of acacia or tragacanth and water, with or without nitre; the chalk mixture with the same substances, small doses of the liquor ammoniæ acet., and the like. Indeed, were it not that it is often necessary, for the satisfaction of the patient or his friends, to administer some medicine internally, the case would often be better left to nature, after the employment of the more active remedies; but if medicines are given, they should be such as are at least harmless. We will venture to assure the inexperienced that they will find such means infinitely more conducive to the recovery of the patient, in the cases now under consideration, than either purgatives, or astringents, or opiates, which we regret to say are so often lavished by those who in their pride of *bold practice*, as it is termed, are accustomed to regard with scorn the treatment we are now recommending. When the disease is prolonged beyond the space of twenty-four or forty-eight hours, or even during this period, if desire for food is urgent, more nutriment may be allowed; but this must be in very small quantity, and either liquid or of the softest deliquescent solids. Of this kind are barley-water, rice-water, arrow-root, sago, weak tea with milk, rice-gruel, weak chicken or veal broth thickened with rice or barley, &c.

In the variety of mucous diarrhœa which occurs in certain epidemic constitutions, and in persons of a sluggish phlegmatic habit, and in which the intestinal tube is rather irritated secondarily by its own morbid secretions than primarily, a different kind of treatment is necessary. Both emetics and purgatives are here indicated; the first to evacuate the contents of the stomach and to stimulate its coats to more healthy action; the last to produce a similar effect on the bowels. Ipecacuan is the best emetic in such cases, and the same medicine, in small quantity, will be very properly combined with rhubarb as a purgative. A useful purgative will also be found in small doses of castor oil combined with a few drops of the ol. terebinth. When by these means the bowels are unloaded of their morbid secretions, and the membrane stimulated to more healthy action, if the diarrhœa still continues it must be checked by mild astringents and tonics, or by small doses of opium. In these cases catechu and kino are found useful; but when such means are necessary, the disease will come under the head of chronic diarrhœa, the treatment of which we shall now notice.

CHRONIC DIARRHŒA.—This form of diarrhœa is that which the practitioner is most frequently called upon to treat, and which he finds by far the most difficult to cure. In addition to the intrinsic severity of the disease, sufficiently evidenced by its long duration, and perhaps in spite of proper treatment, he has probably to contend against many obstacles to recovery which did not exist, or existed in a much less degree, in the acute disease. The patient may have probably an excellent appetite, and cannot or will not refrain from food calculated to keep up his complaint; neither can he be restricted in many other particulars which obstruct recovery, but which the violence of the acute disease either forced him to attend to, or its brevity rendered but little irksome.

Chronic diarrhœa may assume all the forms of the acute variety as far as regards the nature of the evacuations, and most of them may successively appear in the same case; although, generally speaking, the motions preserve one predominating character, as in the acute disease. It is chiefly in the chronic form, however, that the food appears undigested in the stools; a circumstance readily accounted for both by the nature of the two cases and the diet respectively used in them. In many cases of diarrhœa which are chronic both as to time and the moderate severity of the symptoms, the disease is found, on close examination, to consist rather of a frequent return of slight attacks of the acute kind, than to be strictly chronic, in the usual sense of that term. This is an important distinction, and deserves the best attention of the practitioner.

In respect to the treatment of chronic diarrhœa, it may be stated generally, that when the symptoms assume the general character of any of the forms of the acute disease formerly noticed, the treatment to be had recourse to must be similar in kind, but modified by the degree of severity and other circumstances of the particular case. Other modes of treatment will, however, be often necessary, and which would have proved injurious in the acute affection. It is here where the medicines properly termed astringents, and also tonics, are applicable, and which are so seldom proper in any of the acute forms. In numerous cases of the chronic disease such remedies are likewise very improper, and we believe that the great art of treating chronic diarrhœa successfully, consists principally in the practitioner having the skill to discriminate such cases as are benefited by purgatives and astringents, from the very large proportion which are injured by them.

We think it will not be disputed by any practitioner of experience, who has been accustomed to consider diseases more according to their pathological relations than as mere subjects of empirical prescription, that the greater number even of chronic diarrhœas depend not so much on any foreign matter applied to the intestinal mucous membrane, as on some intrinsic irritation of this membrane itself; and, consequently, that the treatment in all such cases is founded not on the indication of evacuating irritating matters, but on that of allaying organic irritation. In a certain proportion of cases, no doubt, such irritating matters are present, and their evacuation is essential to the cure of the disease. Great mischief, however, has arisen from the false notion entertained by many practitioners in this country, that *most* diarrhœas are occasioned by such extraneous sources of irritation, and which can only be relieved by purgatives. We cannot too strongly enter our protest against such a principle as a general rule of practice. The circumstances under which purgatives may be used in recent or acute cases were formerly pointed out; and when similar circumstances exist in the chronic stage, the same treatment will be proper. The accumulation of fæces in the bowels in conjunction with diarrhœa, will always indicate the propriety of purgatives, and they may, in a general way, be considered as not likely to be injurious as long as the stools are feculent. The same observation is equally applicable to those cases in which there appears to be a morbid accumulation of mucus or other secretions in the intestinal tube.

We do not mean to deny that even when the disease consists essentially in an irritation of the membrane, a purgative may not lessen or relieve it; indeed, we know by experience that this is actually the case, and it is only what might be expected from the known effect of stimulant applications to chronic inflammations of other mucous membranes; but we wish the young practitioner to understand that this practice is to be considered as the exception, not as the rule in the treatment of diarrhœa, and that even when a purgative has relieved the symptoms, it is not to be hastily or often repeated. The repetition of purgatives in all bowel complaints requires much judgment and discretion. Aperients may be considered as fairly applicable in cases in which the irritation is of an inactive kind, or where the disease has proved rebellious to remedies of a different class. In such cases rhubarb is perhaps the best purgative.

Another notion, no less false, and perhaps even still more prevalent among practitioners, is, that a great proportion of chronic diarrhœas depend on debility or loss of tone of the intestinal membrane, and are only to be relieved or removed by astringents, tonics, &c. Such a state may undoubtedly exist; but we are well assured that the number of chronic diarrhœas which originate in this cause is extremely small compared with the cases which depend on an irritated or inflamed state of the membrane.

On the whole, we wish the young practitioner to understand that he is to proceed to the treatment of chronic diarrhœa on the only rational principle of endeavouring to ascertain the precise nature of each individual case before he prescribes for it; that he is to give emetics or purgatives where there is evidence that the bowels are oppressed or irritated by fæcal accumulations or morbid secretions; that he is to give astringents and tonics where the flux seems to be the consequence of a debilitated and relaxed state of the mucous membrane; that he is to soothe excessive irritability by opiates; and that he is to remove congestive irritation and inflammation by the means best calculated to effect this object in other parts of the system, namely, by removing all causes calculated to keep up irritation, and by the employment of such means as have the power of directly diminishing the local disease. Our limits will not permit us to enter into the consideration of the characteristic features of each of these different kinds of diarrhœa; but their discovery will not be very difficult to any one who is well grounded in the general principles of pathology, and who will take pains to investigate with attention the history and phenomena of the different cases that come before him.

[Attention has been drawn by Dr. Stokes (*Lectures on the Theory and Practice of Physic*, 1st Amer. edit. p. 87: Philad. 1837,) to a chronic form of diarrhœa, depending upon ulcerations of the rectum, at a short distance from the anus, which may be seen with the aid of the speculum. They occur chiefly in those of broken-down constitutions, and in such as have taken a great deal of mercury. The symptoms are—irritation of the colon, tenesmus, tormina, frequent evacuations, and generally, during the straining, a little blood is passed. Dr. Stokes advises, that the rectum should always be examined, when diarrhœa has been of long standing, has resisted a great variety of treatment, has been combined with tenesmus, and a desire to remain on the night-chair after an evacuation,—which shows irritability of the lower part of the tube; and when the health does not appear to be so much affected as it naturally should be where there has been long-continued disease of a large portion of the great intestine. Since the writer's attention has been directed to this pathological cause of chronic diarrhœa, he has met with several cases, which have been treated successfully by touching them, where practicable, with lunar caustic, or by a strong solution of nitrate of silver—from four to twenty grains to the fluidounce of water.]

We shall conclude this article by some further observations on the principal remedies used in diarrhœa.

Diet.—In all the forms of diarrhœa, acute or chronic, and whatever be the other kind of remedies which are proper, there is one mode of treatment which is universally applicable, and which is the most important of all: this is a proper system of *diet*. This is so important a part of the treatment, that we have no hesitation in stating that the majority of cases of diarrhœa, both acute and chronic, that are curable, may be cured by it alone. In all cases of acute diarrhœa, and in the large class of chronic cases which depend on irritation of the mucous membrane, the food should be very sparing in quantity, of the mildest quality, and such as to leave, after the process of digestion, as little excrementitious matter as possible. In recent attacks of the acute diarrhœa, it is often proper to take no food for the first day, or only mild drinks, containing a small quantity of unirritating nutriment, such as barley-water or arrow-root. During the subsequent days, the same general kind of diet must be continued, but may be given in larger quantity or of greater strength. When the irritation is somewhat allayed, on the third or fourth day perhaps, but not earlier, broths may be allowed, but no solid food of any kind, and, least of all, solid animal food is to be permitted, until the disease is removed or greatly allayed.

The following may be stated as the order in which the articles of diet will generally be found most proper in such cases: barley-water, arrow-root made with water, sago or tapioca, rice-gruel, oatmeal-gruel carefully strained, light broths, with some of the preceding ingredients. In some cases, more especially the chronic kind, a drier diet is found more suitable,—the liquid food appearing to keep up the diarrhœa; but in all cases the ingesta must be of the mildest quality. Rice is one of the most valuable articles of diet in such cases. It should be well boiled and merely moistened with a little broth. While it is extremely mild and unirritating, rice scarcely leaves any remains to be transmitted along the intestines, and this is the reason why it is generally regarded as astringent. As soon as it can be borne, a *small proportion* of the lightest animal food may be taken with the rice. Tender chicken is the best to begin with; then white game boiled; and then roast mutton. The meat of young animals, as lamb and veal, should be avoided. Beef is too stimulant, and fish is bad on account of the large quantity of excrementitious matter it leaves in the bowels. Animal jellies are generally allowable in the case where meat is found to agree; but they often are more irritating to the bowels than the muscular flesh of animals.

In chronic diarrhœa attention to diet is no less necessary, and in general it will be found that the same kind of food is alone proper. It constantly occurs to us to meet with cases of diarrhœa of many months' standing, or which have lasted even for years, and which are speedily removed by the substitution of a mild unirritating diet for the ordinary food of healthy persons. We will here give the outlines of a recent case of this kind, extracted from the out-patients' journal of a public institution to which the writer is attached, and we introduce it the rather because it is *not* an uncommon case.

May 4, 1821. J. G., gardener, æt. 35. Has been affected for two years with his present complaints, which constitute that form of diarrhœa commonly termed *lientery*. During the whole of the above-mentioned period he has had five or six loose stools daily. He has a good, often a craving appetite, but unless he is very particular as to what he takes, he suffers pain, sometimes severe pain, shortly after eating, and a relaxed motion speedily follows. The stools are in general liquid, slimy, dark, and offensive, and frequently contain masses of undigested food. All sorts of hard or solid food disagree, such as tough meats of every kind, pork, cheese, &c., and when taken, appear unchanged in the subsequent motions. More fluid food agrees, such as arrow-root, gruel, rice, broth if not fat, &c. He is much troubled with flatulence, but is never sick at stomach so as to vomit, nor is he thirsty. The tongue is white, with considerable tenderness on pressure, and also distension of the epigastrium; the urine is clear. There is no particular dryness of skin, and he perspires easily on exertion. He has occasional headach, giddiness, and slight palpitation, and the feet are often cold especially at night. He sleeps well, except when pain is present in the bowels. He has lost eighteen pounds in weight during the last twelve months. Notwithstanding the avowed inconvenience produced by certain kinds of food, he does not usually debar himself from them. He also drinks beer, about two pints daily.

This man was directed to alter his diet entirely; to give up all kinds of solid food, and to live on broth, jellies, light puddings, rice, and liquid farinaceous food; to give up drinking beer; and, in a word, to take nothing which he knew to have the effect of irritating his bowels. He was directed to put his feet in warm water every night. The only remedies prescribed were, ten leeches to the pit of the stomach, and a powder consisting of pulv. tragacanth c. ℥ij. potassæ nit. ℈j, to be dissolved in half a pint of cold water, and taken daily in divided portions.

The effect of this change of regimen, (to which the man adhered faithfully) was, that the diarrhœa ceased within three days, and never returned. He was not, however, discharged from the books of the infirmary until the end of July, although he had for some time returned to the use of animal food without suffering any inconvenience: indeed, he said his bowels were then in a better state than he ever remembered them to have been. This man continued well many months after his discharge.

In some cases of chronic diarrhœa, however, particularly those in which astringent medicines are found useful, a solid diet of a more stimulating quality, with a moderate proportion of wine, is found much more useful than the bland unirritating food above mentioned. In such cases the dry and tonic diet has the effect of producing motions of a more solid kind; while at the same time it tends at once to restore the lost tone of the bowels and the general strength. In practical medicine we must never follow our pathological principles so far as to be blind to the results of experience; and in diarrhœa, as in every other disease, however we may allow to science the initiatory in prescription, it is the observation of a favourable result alone that can justify perseverance in any kind of regimen or medicinal treatment.

Leeches.—In the case above detailed we are disposed to attribute nearly all the good effects to the change of diet; but the application of leeches, even for a single time, was probably of benefit. We judge so from the marked benefit we constantly find from their use in this complaint, whether in the acute or chronic form. When the diarrhœa is evidently complicated with a state of irritation or slight inflammation of the mucous membrane of the stomach and small intestines, the treatment should begin with the application of leeches to the epigastrium. If this and the appropriate diet fail, then leeches must be applied to the anus, or to this part in the first place, if the diarrhœa is uncomplicated with gastric irritation. For the relief of the inflammatory irritation of the large intestines, there can be no doubt that leeches applied to the anus are greatly more efficient than when placed on the abdomen. This remedy is indeed possessed of remarkable powers in the disease, often working, according to the common expression, "like a charm," even in cases of very long standing and of different external characters. Combined with proper diet, indeed, we are persuaded that the greater number of diarrhœas, both acute and chronic, will yield to this method, with little or no aid from other medicine. We have repeatedly known a diarrhœa of long standing, more particularly in the case of infants, cured by a single application of two or three leeches only; and in more obstinate cases it will be found that an instantaneous and marked remission of the symptoms follows every repetition of the remedy. Although, in our own practice, we always combine with the use of leeches, in the cases where they are indicated, a proper diet, yet we have had ample evidence of their unassisted powers in checking or removing diarrhœas of great severity and obstinacy. We would add one caution, which may be useful to those not in the habit of making much use of this remedy:—to ensure the full effect, the leeches should be applied immediately to the anus, that is, as close to the mucous membrane of the extremity of the rectum as possible. Unless accurate directions are given, nurses will be apt to mistake our meaning. It has frequently happened to us to find the prescription of *hirudines ano* carried into effect by their being applied to the buttock, perineum, or even sacrum.

Bathing.—In most of the cases in which an unirritating diet and the local detraction of blood are beneficial, the employment of some form of the tepid or warm bath will be useful. Although the general bath is often indicated, and is the best form of the application, yet in the majority of cases we find that the frequent use of warm fomentations to the bowels by means of flannel bags of bran, with the foot-bath at bed-time, answers completely in promoting the removal of the intestinal irritation. (See BATHING.)[*]

Opiates.—Of the means calculated to assist in the cure by affording temporary relief from pain, as well as by directly allaying the irritated condition of the bowels, no remedy equals the use of opiate injections. In all cases where there is tenesmus with pain and frequent stools, this remedy is to be had recourse to as a means of temporary relief, whatever other plan may be pursued for the permanent cure of the disease. Solid opium, or extract of poppy, carefully rubbed down into mucilage, or the pulvis opii, Battley's liquor, or the common tincture, may all be used. Perhaps the pulvis opii is, on the whole, the most convenient form; of which one, two, or three grains may be administered in a couple of ounces of starch mucilage. This may be repeated according to the urgency of the case; but the student is to be earnestly cautioned not to be seduced by the relief often produced by this application, into the neglect of means of more permanent efficacy.

Astringents.—It will not, we trust, be imagined, from the manner in which we have recommended the use of the foregoing remedies, that we consider the treatment of diarrhœa by the use of astringent medicines, properly so called, as generally either useless or improper. On the contrary, we know that cases of this disease are every now and then met with, that can only be cured by such medicines; and that they are very often necessary, at least as palliatives, in the chronic form of diarrhœa. Sometimes nothing else affords relief. All that we labour to impress on the mind of the young practitioner, or on those who have unfortunately been taught to treat diseases as mere collections of symptoms, without reference to pathology, is, that there are many kinds of diarrhœa which can be best treated without astringents and without purgatives; and that the presence of frequent fluid dejections does no more necessarily indicate the use of such remedies, than any other single symptom necessarily indicates a peculiar treatment, without reference to the whole disease of which it is but a part.

In all cases, before we have recourse to astringents, the state of the patient must be carefully examined into, the nature of the evacuations, the state of the abdomen, &c.; lest some inflammatory affection should still remain and keep up the

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[*] Riverius gives his own case in testimony of the efficacy of the warm bath in diarrhœa. "Correptus sum diarrhœa biliosa, tanta acrimonia prædita ut anum eroderet, ardoremque urinæ concitaret. Dysenteria erat in procinctu. Ingressus semicupium tepidum, illico liberatus sum.—River. Op. Univ. p. 500.

the diarrhœa. Astringents are a class of remedies which seldom fail to do mischief when they do not do good. They are indicated in the cases where the diarrhœa appears to be kept up by loss of tone, or by a morbid degree of irritability, not dependent on vascular orgasm or inflammation, in the mucous membrane of the bowels; and they are properly used in all chronic cases which have resisted the means calculated to relieve active irritation, or other known pathological conditions, as noticed above.

For the particular forms of astringents most useful in such cases we must refer to writers on Materia Medica, and to the article ASTRINGENTS in the present work. We can only afford space here for a few observations.

The astringent substances from the vegetable kingdom that have been used in alvine fluxes are extremely numerous; and it is probable that some of these not now included in our pharmacopœias, or, if included, not much employed, are not the least useful. Catechu and kino are now in most common use, probably not so much because they are in reality the best remedies, as because they are the strongest astringents. They are, however, often very useful in the cases of diarrhœa wherein remedies of this class are indicated. Both these substances may be given separately, or in combination with opium or other astringents. One of the most usual forms of prescription is the tincture of catechu in chalk mixture, combined with equal parts of the tincture of cinnamon. In other cases the watery infusion of catechu answers better, in the form of the infus. catechu comp., and may be given in doses of one or two ounces after every loose motion.

Dr. Pemberton had an idea that kino had some peculiar virtues as an astringent; that it did not act as such except diarrhœa were present. He therefore gave it the preference to other astringents. His mode of administration was in doses of a scruple made into a bolus with opiate confection. (Treatise on Diseases of Abdom. Visc. pp. 112 and 149.) More recently an extensive series of experiments on the effect of kino in diarrhœa, were made in the hospital of *La Pitié*, in Paris, by M. Bally. In chronic diarrhœa, unaccompanied by fever or marks of inflammation in the mucous membrane, the continued use of the remedy, even for a short time, was found almost invariably effectual in stopping the diarrhœa. In one case of three years' standing it effected a cure. But the most remarkable result of M. Bally's experiments is the alleged fact—that the kino, given in doses of twelve or fourteen grains for several days in succession, succeeded in curing diarrhœas attended by febrile and inflammatory symptoms. (Med. Gazette, vol. v. p. 700.) We confess we are surprised at such a result.

Logwood, tormentil, and bistort were more employed formerly than at present as astringents. We believe the former to be a valuable remedy: the best form of using it is decoction, which may likewise be made the vehicle for more active remedies. The plantain (*plantago*) was much used by the older authors; and it and many other vegetables were taken boiled in broths and demulcent ptisans—a form of medicinal administration too much fallen into disuse in this country. Unripe medlars were formerly famous for their occasional effects in diarrhœa; but we apprehend the cases are few in which they can be recommended.*

Among the mineral astringents, lime and its carbonate deserve attention, as being in most common use, and as being perhaps not the less useful because they are possessed of only moderate astringency. In certain mild forms of diarrhœa, particularly after the use of purgatives, the pulv. cretæ comp., with or without opium according to circumstances, is a very mild and valuable remedy; and the mistura cretæ, it need hardly be said, is the common and one of the best vehicles for other more powerful astringents. In the more chronic forms of diarrhœa lime-water has been found occasional useful, taken in large quantities as a beverage; and it is very properly combined in such cases with gum, and often with milk. Equal parts of lime-water and milk, with acacia or tragacanth, is a favourite remedy with many old practitioners. Alum is a medicine given frequently in a somewhat similar form, under the name of *alum whey*, which is made by adding two drachms of the alum to a pint of boiling milk: of this whey a glassful or three or four ounces may be taken as a dose. Alum is also given in a solid form, in bolus or pill, combined with kino, catechu, or opium. The stronger mineral astringents, the acetate of lead and sulphates of copper and zinc, are occasionally useful, particularly the sulphate of copper; but this remedy is chiefly applicable in a form of the disease which does not come properly under our notice in this article, the diarrhœa of phthisis.

[The solution of persesquinitrate of iron and the tincture of chloride of iron are said to have succeeded when other remedies had failed. (See the writer's *New Remedies*, 4th edit. p. 294: Philad. 1843, in regard to the former.) The artemisia vulgaris, carbo animalis, and ferri ferro-cyanuretum have been recommended of late years; but there is no reason for believing that they are superior to other vegetable and mineral tonics.

Of late, a mixture called *Hope's Mixture*, from its proposer, which consists of nitrous acid and opium, forming a nitrate of morphia, has been highly extolled, in the United States more especially; but it has not succeeded more frequently with the writer than other remedies suggested by the nature of the case. It is composed as follows: ℞. Acid. nitros. f.ʒi; Aquæ camphor. f.℥viij; Tinct. opii gtt. xl.—M. Dose, a fourth part, every three or four hours.

The balsams and turpentines have been much prescribed. Of these the copaiba and the oleum terebinthinæ are alone employed at the present day. Nux vomica and its active principle have, likewise, been used, and occasionally with great advantage.]

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* Forestus relates a case of diarrhœa which seems to have been most particularly obstinate, since he informs us that the poor patient "omnem suam substantiam frustra in medicorum ope consumpserat, consilii causa, ut ab hoc malo liberari posset," but which he (Forestus) cured in a few days by giving him a great quantity of unripe medlars to eat. The same author tells us of a patient of Spirinchius, who was cured of an equally obstinate diarrhœa by the same means; but Spirinchius was more fortunate in a richer patient, "qui medico trecentos aureos pro sola mespilorum præscriptione numeravit." Forest. Op. tom. iii. p. 47.

In this and other forms of diarrhœa depending on disorganization of the bowels, opiate clysters are commonly found most effectual. A simple form of injection recommended by Van Swieten is also found occasionally beneficial in this distressing complaint: it consists simply of an ounce of treacle or juniper-rob in three or four ounces of warm milk. (Comment. vol. ii. p. 394. *Diarrhœa Febrilis.*)

In every form of chronic diarrhœa, warm clothing with flannel next the skin, and an additional quantity on the abdomen, in the form of a belt or swathe, is highly useful. In many cases, also, warm galbanum plasters and other warm external applications to the abdomen are very beneficial. This mode of treatment was much used by the older authors. (See Forestus *passim.*)*

It is hardly necessary in all such cases to dwell on the propriety of the patient being lodged in a dry well-ventilated chamber; or of the advantages of a mild and dry climate. Chronic diarrhœa is, indeed, one of the diseases in which a change to a warmer and drier climate than ours is found most beneficial, (see CLIMATE); and this leads us to notice the fact well known to travellers, and to physicians who have had much to do with travelling invalids, that a journey is almost specific in arresting diarrhœa.

JOHN CRAMPTON.
JOHN FORBES.

ADIPOUS DIARRHŒA *molten grease*, the *gras fondure* of the French, is characterized by a discharge of fatty matter from the bowels, sometimes in a fluid state, at others in the form of fatty concretions. Many cases of the latter are recorded; and, of late years, attention has been especially directed to the former. In one case related by Sir Everard Home, the fatty discharges might be accounted for by the patient's habit of taking castor oil regularly; but in other cases, the adipous discharges are evidently at the expense of the system.

At times, the discharge is in the form of oil, or semi-concrete matter floating on the top of the fæces, and possessed of a fetid odour. The quantity evacuated differs greatly. In one case, which occurred to Dr. J. B. Jackson, of Boston, it amounted on the average, in twenty-four hours, to about eight ounces during more than four months.

Some fatty concretions, analyzed by Lassaigne and L. Gmelin, had the following constituents: seventy-four parts of an acid fatty matter, in which stearin predominated, elain and a peculiar acid; twenty-one parts of a substance analogous to fibrin; four parts of phosphate of lime and one part of chloride of sodium. In another case, there were, in one hundred parts, sixty of matter similar to spermaceti; thirty of phosphate of lime; eight of animal matter, and two of loss.

In many of the cases of fatty discharge, there was concomitant disease of the liver, pancreas or duodenum; so that it was imagined the anomalous secretion might be the product of the pancreas or the liver. On the other hand, in some of the cases on record, the ducts of the liver and pancreas have been so obstructed as to preclude the idea of its being the product of either of these viscera; and moreover it has been seen in cases in which there was no reason to believe in the existence of serious disease of those organs. At the age of three years, a little girl was observed to discharge something from the bowels as she walked across the room; this, when examined, was found to be fat in a liquid state, which concreted when cold. "Ever since that time to the present," (a period of eighteen months,) "she has voided," says Dr. Babington, — the respectable narrator of the case,—"at intervals of ten or fourteen days, the quantity of from one to three ounces, sometimes pure, at others mixed with the fæces: when voided, it has an unusually yellow tinge, and is quite fluid, like oil. Her appetite is good, as well as her spirits, and her flesh firm, her belly rather tumid but not hard." In other cases, the disease appears to have occurred during phthisis, hysteria, and other affections; in some instances, oil was discharged from the bladder likewise, and fatty concretions have been taken from the vagina. One of these was examined chemically by Dr. Martius, jr., and found to be composed of fat with some traces of salts.

These facts sufficiently establish, that under certain circumstances, and, doubtless, under the influence of particular diseases of the neighbouring organs, the gastro-enteric and other mucous membranes may secrete fat from the blood, as the physeter macrocephalus occasionally secretes an enormous quantity of fat under the form of ambergris:—as much, it is asserted, as one hundred and eighty-two pounds have been found in the body of one of these animals.

Treatment. — Where organic disease exists, the efforts of the practitioner may be fruitless; but where the affection consists of a vicarious secretion from the mucous membrane of the intestines, it may admit of cure. The best mode of management would seem to be, to attempt a thorough revolution in the whole system of nutrition by change of diet, and an entire mutation of all the atmospheric and other influences surrounding the patient. Mercurials and other agents belonging to the class of eutrophics,—iodine, and its various preparations, for example,—may be serviceable in this view; and we may be able to comprehend, that new impressions made on the nerves by the various remedies recommended in hysteria, may put an end to the adipous secretion in hysteric individuals, by removing the irregularity of the nervous and other functions, which constitute that protean malady.

ROBLEY DUNGLISON]

DIETETICS. — An organised body, whether of the animal or vegetable kingdom, cannot sustain the functions of life without a certain expenditure, or consumption of the materials of which it consists; and it is evident, therefore, that every living being, in order to continue its existence, must possess the means of receiving and assimilating to itself foreign matter for the repair of its diurnal waste. It is upon this necessity that the want of food is founded; its judicious administration must be directed upon principles the knowledge of which can be alone derived from the sources of physiology and chemistry.

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* Quibus adjungenda sunt *topica*, olea, unguenta, linimenta et fotus, ungnenta et irrigationes, ex oleo omphac. rosaceo, myrteo, cotoneorum cum vino adstringente, cerata, &c. Forest. vol. iii. p. 58.

The possession of a receiving canal, or internal cavity of some kind, would appear to be exclusively characteristic of the animal creation; and Cuvier has distinctly stated that he knows of no animal unprovided with such an apparatus. In plants, on the contrary, which never contain any organ analogous to an internal stomach, the fluid supplies are absorbed by pores on their surfaces; and although some physiologists have questioned the propriety of so sweeping a generalization, minute investigation has shown, that so far from being real, the instances adduced by them in support of their objection are only apparent exceptions to this general law of nature. To enter upon this wide field of inquiry would be altogether foreign to the practical objects of the present article; nor can we undertake to examine the great diversity of means which Nature employs in the different orders of animals for the conversion of food into nourishment or into blood; we shall only observe that with such nicety are the processes of waste and supply adjusted, that whatever may be the quantity of food taken, or however the circumstances under which it is consumed may vary, the same individual, after having augmented in weight in proportion to the quantity of ingesta, will return in the space of twenty-four hours to nearly the same standard, provided the development of growth, or the existence of disordered function, does not interfere with the result. During this period, the food has been decomposed, and re-combined into compounds analogous to those which constitute the organs to which it is carried; and this would appear to take place, however remote its composition may be from that of the structures with which it is assimilated. It is, however, important to notice that the extent of the digestive cavity bears a relation to the nature of the food it is destined to receive, and by which the animal is designed to be nourished; for the more dissimilar its composition to that of the body it is to recruit, the longer must it remain in its alimentary cavity, and the more complicated must be the changes which are to perfect its transmutation. We thus find that carnivorous animals have generally less capacious and complicated organs than the herbivorous tribes; and that amongst the latter, those that feed upon seeds or fruits, with the exception of the *ruminantia*, have them less so than those which live upon leaves or the entire vegetable. The digestive canal of man is less capacious and complex than that of other mammalia which live entirely on flesh; whence we may infer that in a state of nature he may be capable of subsisting either on animal or vegetable food, and that he is not only qualified for every diversity but for every admixture of it. Thus do we see that, while many savage tribes exist almost entirely on fruits and roots, others are as exclusively fed on raw animal flesh. The Hindoos, for instance, live upon rice; the Lombard peasants upon maize; the West Indian negroes fatten upon sugar, those of Senegal upon gum; while the Esquimaux gluts himself with the blubber of the seal. It would appear, however, that although man may subsist upon almost every variety of food, he cannot bear with impunity a sudden transition from one species to another. This circumstance was well exemplified in the eastern part of France in the year 1817, where the failure of the crops occasioned such a famine that the poor were compelled to feed upon whatever vegetable productions could be found: the consequences are stated to have been general anasarca, interruption of the menstrual discharge, a diminution of the ordinary number of conceptions by at least one half, and a permanent injury to the health. Even the sudden return to the use of barley bread, after the continuance of this miserable regimen for three months, M. Gaspard informs us, was not unattended with danger. Spallanzani has satisfactorily shown that animals may be brought to live on food of the most opposite kind, provided the change from their usual diet be *gradually* accomplished,—such, for example, as a pigeon on flesh, an eagle on bread, &c. We know that in certain maritime districts of the East, horses are not unfrequently fed upon fish, while on the coast of Coromandel they are fattened upon balls of boiled flesh mixed with grain; and it is on record that a lamb kept on ship-board was fed with flesh until it refused the grass when afterwards turned into a meadow. Such facts have induced some physiologists, amongst whom we may mention the distinguished name of Dr. Bostock, to consider it probable that all the anatomical varieties in the structure of the stomachs of different animals may be resolved into their *mechanical* effects upon the aliments submitted to their action; and that, whatever may be the chemical composition of the food, provided it be sufficiently comminuted or triturated, it will be equally acted upon by the gastric juice. We might here ask whether the nature of the digestive solvent itself may not at the same time vary with that of the food which excites its secretion, and whether in this way Nature, if not abruptly called upon, may not adapt her measures to her necessities?

Although it is not our intention to discuss, at any length, the question as to whether Nature originally intended that we should feed on animal or vegetable food, nor to follow the train of those speculative authors who have endeavoured to prove that animal food was not eaten before the deluge, but was introduced in consequence of the deterioration which the herbage sustained on that occasion,—there are, nevertheless, several points connected with the first of these questions which we consider as deserving some notice. Reasoning from the data afforded us by the researches of the comparative anatomist, we are undoubtedly authorised in pronouncing man to be an *omnivorous* animal, and this is perhaps the only generalisation of which the subject is susceptible; Broussonet, however, has ventured so far to refine upon this proposition as to decide upon his being more herbivorous than carnivorous in his nature; and, from the proportion which the different teeth bear to each other, he concludes that his mixed diet should consist of animal and vegetable food in the proportion of twenty to twelve. It is, however, quite clear that no rule of this kind can possibly be established. We have only to consider the different effects produced upon the body by these two species of food, to perceive that the circumstances of climate, season, exercise, habit, age, and individual peculiarity must at once oppose such an admission.

As every description of food is converted into blood, and since the flesh and blood of carnivorous and herbivorous animals do not differ very materially from each other, it may be inferred that the ultimate effect of all aliments must be virtually the same; and that the several species can only differ from each other in the quantity of nutriment they afford, in the comparative degree of stimulus they impart to the organs through which they pass, and in the proportion of vital energy they require for their assimilation. Now were the degree of excitement which attends the digestion of a meal commensurate with the labour imposed upon the organs which perform it, it is quite clear that less irritation and heat would attend the digestion of animal than of vegetable food; for in the one case the aliment already possesses a composition analogous to that of the recipient, and requires little more than division and depuration; whereas in the other a complicated series of decompositions and recompositions must be effected before the matter can be animalised, or assimilated to the body. But the *digestive fever*, (if we may be allowed to apply such an expression to a healthy process,) and the complexity of the alimentary changes, would appear in every case to bear an inverse relation to each other. This must depend upon the fact of animal food affording a more highly animalised chyle, or a greater proportion of that principle which is essentially nutritive, as well as upon the immediate stimulus which the nerves receive from its contact. In hot countries, therefore, during the heat of summer, we are, as it were, instinctively led to prefer vegetable food; and we accordingly find that the inhabitants of tropical climates select a diet of this description. The Brahmins in India, and the people of the Canary Islands, Brazils, &c., live almost entirely on herbage, grains, and roots, while those of the north use little beside animal food. On account of the superior nutritive power of animal matter, it is equally evident that the degree of bodily exertion, or exercise, sustained by an individual, must not be overlooked in an attempt to adjust the proportion in which animal and vegetable food should be mixed. Persons of sedentary habits are oppressed, and ultimately become diseased, from the excess of nutriment which a full animal diet will occasion; such a condition, by some process not well understood, is best corrected by acescent vegetables. It is well known that artisans and labourers, in the confined manufactories of large towns, suffer prodigiously in their health whenever a failure occurs in the crops of common fruits. This fact was remarkably striking in the years 1804 and 1805. Young children* and growing youths generally thrive upon a generous diet of animal food; the excess of nutritive matter is consumed in the development of the body, and if properly digested imparts strength without repletion. Adult and old persons comparatively require but a small proportion of aliment, unless the nutritive movement be accelerated by violent exercise and hard labour.

Those who advocate the exclusive value of animal food, and deny the utility of its admixture with vegetable matter, adduce in support of their system the rude health and Herculean strength of our hardy ancestors. The British aborigines, when first visited by the Romans, certainly do not appear to have been conversant with the cultivation of the ground, and according to the early writers, Cæsar, Strabo, Diodorus Siculus, and others, their principal subsistence was on flesh and milk; but before any valid conclusion can be deduced from this circumstance, the habits of the people must be compared with those of their descendants. The history of later times will furnish us with a satisfactory answer to those who deny the necessity of vegetable aliment. We learn from the London bills, that scurvy raged to such an excess in the seventeenth century as to have occasioned a very considerable mortality: at that period the art of gardening had not long been introduced. It appears that the most common articles of the kitchen-garden, such as cabbages, were not cultivated in England until the reign of Catharine of Arragon; indeed, we are told that this queen could not procure a salad until a gardener was sent for from the Netherlands to raise it. Since the change thus happily introduced into our diet, the ravages of scurvy have been less severely experienced.

It follows, then, that in our climate a diet of animal food cannot with safety be exclusively employed. It is too highly stimulant; the springs of life are urged on too fast; and disease is the necessary consequence. There may, nevertheless, exist certain states of the system which require such a stimulus, and there may also exist a condition of the digestive organs which renders them incapable of assimilating vegetable food; the physician, therefore, may occasionally confine his patient to an animal regimen with as much propriety as he would prescribe opium or any other powerful remedy. By a parity of reasoning, the exclusive use of vegetable food may be shown to be inconsistent with the acknowledged principles of dietetics, and to be incapable of conveying a nourishment sufficiently stimulating for the active exertions which belong to our present civilized condition. At the same time, it must be allowed that an adherence to a vegetable diet is usually productive of far less evil in sedentary habits than that which follows the use of an exclusively animal regimen.

A very curious chapter might be written upon the adverse opinions which the physicians of different ages have maintained as to the importance of dietetic observances for the preservation of health and the cure of disease. Hippocrates was the first who attempted to establish any general principles upon the subject of dietetics; but accurate as he was in all his observations of the phenomena of disease, and admirable as are his precepts for its management, so warped were his notions with regard to the nature of aliments, by an absurd and predominating theory, that, instead of gathering from the stores of his experience any useful information, we find nothing but a mass of the most extraordinary conceits. Assuming as the directing principle of all his researches, that living bodies contain two elements, differing in power but agreeing in purpose, viz. *fire* and *water*, which, with their consequences, heat and dryness, moisture and cold, he considers as necessary and sufficient for the maintenance of all the functions, —the water nourishing and the fire setting in motion.—he proceeds, after showing that disease arises from the deficiency of one or the other of these elements, to enumerate the different articles of diet which, from their heating, drying, moistening, and cooling tendencies, are best calculated to counteract such morbid states. He tells us, for instance, that fowls of every kind are drier than quadrupeds, because they have no bladder, and neither secrete urine nor saliva; thereby showing that the heat of the body dries up its moisture. Their eggs, he says, are strong, nourishing, and inflating; strong, because they contain the germ of an animal,—nourishing, because they nurse it, as it were, with milk,—and inflating, because they become dilated from a tiny particle to a large size. But it was not to be expected that, anterior to the discovery of the circulation of the blood, or to the existence of chemistry as a science, any rational views could be entertained upon a subject so entirely dependent upon such knowledge for its explanation. There exists, however, a connection between a class of phenomena which the ancient physicians recognised, and which the moderns appear to have too hastily disclaimed,—we allude to what they termed *non-naturals;* so called from their not being essential to the mere nature or constitution of living animals, and which, besides the different aliments, included air, exercise, sleep, the excretions, and the passions of the mind. In the second part of this article, it will be the endeavour of the writer to point out and enforce upon the mind of the practitioner, the very important relations which obtain between the different stages of digestion and the non-naturals above enumerated.

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* The aliment of almost every animal, in its first stage of life, is composed of animal matter; even the graminivorous birds are nourished by the yolk of the egg for several days after being hatched.

In modern times, the multiplied resources of pharmacy, and the discovery of new chemical agents, have naturally enough led practitioners to depend upon such remedies for the cure of chronic disease rather than upon a modified plan of diet; while, in the circle of the profession, a certain degree of distrust, or we might even add of opprobrium, has fallen upon such practitioners as have insisted upon its paramount importance. This circumstance easily admits of explanation. In physic a remedy or a practice has never been discarded by the regular practitioner but it has immediately found a patron in the empiric, who seizes upon it with avidity, in order to convert it to his own advantage, just as the rabble dress themselves in the cast-off clothes of their superiors.

The minor writers who have swarmed within the last half century have greatly contributed to throw discredit upon the subject. Nothing cherishes the public scepticism, with regard to the efficacy of the medical art, so much as the publication of the adverse and contradictory opinions of its professors upon points so apparently simple and obvious, that every superficially informed person constitutes himself a judge of their merits. If a reader is informed by one class of authors that a weak stomach is unable to convert *liquid* food into aliment, and by another that *solid* food is injurious to feeble stomachs, he at once infers that the question is one of perfect indifference; and ultimately arrives, by a very simple process of reasoning, at the sweeping conclusion that the stomach, ever kind and accommodating, indiscriminately converts every species of food into nourishment, and that he has therefore only to consult his own inclination in its selection. On the valetudinarian, incapable of healthy reflection, and ever seeking for causes of fear and anxiety when they do not choose to come uncalled, such works may have a contrary tendency, and lead him to suspect the seeds of disease in every dish, and poison in every cup.

It appears to us that authors have in general laid far too great stress upon the quality of the different species of food, and have condemned particular aliments for those effects which should be attributed to their quantity, and still more perhaps to the circumstances under which they were taken; their dietetic precepts have therefore frequently assumed the air of ascetic austerities, and they have thus represented the cure far more formidable than the disease. It has been sarcastically observed by a popular writer, more remarkable for the playfulness of his style than for the soundness of his logic, that there exists a more intimate connection between the doctrine of Tertullian and that of many a dietetic practitioner, than is generally supposed; that he is the ascetic intrenched in gallipots and blisters, preaching against beef and porter; terrifying his audience with fire and brimstone in one age, and in the other with gout and apoplexy. Now, while we must all deeply lament that the severity of this sarcasm should have been in some measure sanctioned by the theoretical absurdities of many of our writers, it is impossible that any reasonable person can seriously contend that numerous diseases do not arise from an improper management of diet; much less that a judicious regulation of it cannot be rendered subservient to their cure. To those, however, if such there be, who do question the importance of dietetics, we have only to observe that they may as well deny the utility of the medical art altogether, and assert that, in all disorders of function, Nature is sufficiently powerful to rectify and cure them, without the intervention of art. Unless this be granted, it is absurd to say that beneficial impressions may not be made as well through the medium of the *materia alimentaria* as through that of the *materia medica;* or, to borrow the language of Dr. Arbuthnot, that what we take daily by *pounds* must not be, at least, as important as what we take seldom, and only by grains or tea-spoonsful.

To get rid of such a difficulty, a class of philosophers admit the salutary influence of particular aliments in rectifying disorders of function, but deny the necessity of reason or philosophy for the selection or management of them, since they consider that Nature has implanted in us instincts sufficiently strong and intelligible to direct us, under all circumstances, to what is salutary, and to warn us from such food as may be injurious. We may observe in reply, that man has so long forsaken the simple laws which Nature had instituted for his direction, that it is to be feared she has abandoned her charge, and left him under the control of that faithless guide and usurper, to which civilization has given birth. Appetite, which expresses the true wants of the system, can no longer be distinguished from that feeling which induces us to prefer one species of food to another, and which is the offspring of habit, and the consequence of artificial associations. Nor must it be forgotten that, during disease, the senses frequently lose their tact, and the invalid experiences an appetite for things that would be prejudicial.

That the natural relations which subsist between the qualities of food and the impressions made by them on the senses, are changed or destroyed by the refinements of artificial life, is a fact supported by many powerful arguments. How many kinds of aliment, originally disagreeable, become pleasant by habit? and how many substances, naturally agreeable, become disgusting from the creation of certain prejudices? We are acquainted with a lady who is always made sick by eating a green oyster; the cause of which may be traced to an erroneous impression she received with respect to the nature of the colouring matter. Dr. Fordyce has urged a still more serious and conclusive objection to that hackneyed maxim, "that we ought to live *naturally*, and on such food as is presented to us by nature," viz., that *man has no natural food.* It is decreed that he shall earn his bread by the sweat of his brow; or, in other words, that he shall by his industry discover substances from which he is to procure subsistence; and that, if he cannot find such, he must cultivate and alter them from their natural state. There is scarcely a vegetable which we at present employ that can be found growing naturally. Buffon states that our wheat is a factitious production, raised to its present condition by the art of agriculture. Rice, rye, barley, or even oats, are not to be found wild, that is to say, growing naturally, in any part of the earth, but have been altered, by the industry of mankind, from plants not now resembling them in such a degree even as to enable us to recognise their relations. The acrid and disagreeable *apium graveolens* has been thus transformed into celery; and the *colewort*, a plant of scanty leaves, not weighing altogether half an ounce, has been improved into cabbage, whose leaves alone weigh many pounds; or into a cauliflower of considerable dimensions, being only the embryo of a few buds, which, in their natural state, would not have weighed many grains. The potato again, whose introduction has added so many millions to our population, derives its origin from a small and bitter root, which grows wild in Chili and at Monte Video. If any of our readers, in the face of such facts, still remain sceptical upon the subject of these metamorphoses, let them visit the fairy bowers of horticulture, and they will there perceive that her wand has not only converted the tough, coriaceous covering of the almond into the soft and melting flesh of the peach, but that, by her spells, the sour sloe has ripened into the delicious plum, and the austere crab of our woods into the golden pippin; that this again has been made to sport in almost endless variety, emulating in beauty of form and colour, in exuberance of fertility, and in richness of flavour, the rarer productions of warmer regions and more propitious climates. If cultivation can ever be said to have left the transformation of vegetables imperfect, the genius of cookery is certainly entitled to the merit of having completed it; for whatever traces of natural qualities may have remained, they are undoubtedly obliterated during their passage through her potent alembic.

After all, then, experience can alone supply the want of instinct, and form the basis of a rational system of dietetics. Experience, dearly bought experience, has taught us that headach, flatulency, hypochondriasis, and a thousand nameless ills, have arisen from the too prevailing fashion of loading our tables with a host of *entremets* and *hors d'œuvres*, which have too frequently usurped the roast beef of old England. The theorist, in the true spirit of refinement, laughs at our terrors: he admits, to be sure, that the man who eats round the table, "ab ovo usque ad mala," is a terrific glutton, but that, after all, *he has only eaten words;* for, eat as he may, he can only eat animal matter, vegetable matter, and condiment, either cooked by the heat of water or by that of fire,—figure or disfigure, serve, arrange, flavour, or adorn them as you please. There is not a physician of any practical knowledge who cannot, at once, refute such a doctrine by a reference to facts; every old nurse knows from experience, that certain mixtures produce deleterious compounds in the stomach, although the chemist may, perhaps, fail in explaining their nature, or the theory of their formation. What would such a reasoner say, if he were invited to a repast, and were presented only with charcoal and water? Would he be reconciled to his fare by being told that his discontent was founded on a mere delusion,—that the difference between them and the richest vegetable viands was merely ideal,—*an affair of words*,—as, in either case, he would only swallow *oxygen, hydrogen*, and *carbon?* And yet we will venture to assert that the presumption in such a case would not be more violent, nor more opposed to the just principles of physiology and chemistry, than is the argument by which the sciolist attempts to defend a practice which converts our refreshments into burdens, and our food into poison.

I. Materia Alimentaria.

Those bodies which have possessed life can alone be strictly considered as affording aliment to animals; and yet there exist a certain number of inorganic substances, such as water, common salt, lime, &c. which, although incapable by themselves of nourishing, appear, when administered in conjunction with the former, to contribute essentially to nutrition. The consideration, therefore, of the *materia alimentaria* necessarily embraces, not only the *substantive* agents above stated, but those accessories which from their *modus operandi* might properly enough be entitled alimentary *adjectives*. Under the former division will be arranged all the varieties of animal and vegetable food; under the latter, the class of *condiments* will merit our attention.

The arrangements which different authors have proposed for the classification of alimentary substances will be found to vary according to the particular theory by which each may have been influenced. The chemist investigates the composition of an aliment, and arranges it either according to the ultimate elements of which he supposes it to consist, or according to the proximate principles which he considers to predominate in its composition. The naturalist, on the other hand, merely inquires to what division in his zoological system each article of diet belongs, and assigns to it a corresponding place in his arrangement; while the experienced practitioner is disposed to distribute the *nutrientia* in an order which answers to his notions of their relative nutritive value, or to the supposed facility with which they are dissolved in the stomach: thus, for example, as he finds from experience that the darkest coloured flesh generally contains more nourishment, while it stimulates the system more powerfully than the whiter kinds, he distributes venison, beef, mutton, hare, &c. into one group, while lamb, veal, and the white meats, such as that of turkey, partridge, pheasant, chicken, &c. he considers as constituting a different class.

Chemists have been ever anxious to reduce all nutritious substances to some one or more proximate principles. Haller attempted to resolve them into one elementary jelly. Cullen was of opinion that the matter of nutrition is, in all cases, either oily or saccharine, or what seems to be a combination of both these principles. Fordyce reduced all nutritious matter to mucilage; but since he admits of a *farinaceous* mucilage, a *saccharine* mucilage, &c., Dr. Bostock very justly remarks that the inaccuracy with which he may be charged is but of a verbal description. Richerand attempted to show that the nutritive principle is in all cases either gummy, mucilaginous, or saccharine. Dumas is disposed to regard "mucus" as the *principe eminemment nutritif*," by which he probably means albumen, since he observes that it forms the basis of our organs. Dr. Prout, whose researches in organic chemistry claim our highest attention and respect, has stated that he considers that there exist three great natural classes or groups, which essentially constitute the groundwork of all organized beings, which he denominates the *saccharine*, the *oleaginous* and the *albuminous*.

[The classification of Dr. Prout has been taken by Dr. Pereira (*A Treatise on Food and Diet*, Amer. edit. by Dr. C. A. Lee, p. 38, New York, 1843) as the basis of his own, which includes twelve divisions:—the *aqueous; mucilaginous*, or *gummy; saccharine, amylaceous, ligneous, pectinaceous, acidulous, alcoholic, oily* or *fatty, proteinaceous, gelatinous* and *saline*. By the combination of these alimentary principles and simple aliments, our ordinary articles of food, or compound aliments, are formed.]

M. Magendie has distributed the nutrientia into nine classes, according to the predominance of one or more of those proximate principles, upon the presence of which modern science has assumed that the nutritive qualities of substances mainly depend.

The following is his arrangement:

I. Fibrinous Aliments.—Comprehending the flesh and blood of various animals, especially such as have arrived at puberty;—venison, beef, mutton, hare.

II. Albuminous.—Eggs, &c.

III. Gelatinous.—The flesh of young animals; veal, chickens, calf's foot, certain fishes.

IV. Fatty and oily.—Animal fats, oils, butter, cacoa, &c.; ducks, pork, geese, eels, &c.

V. Caseous.—The different kinds of milk, cheese, &c.

VI. Farinaceous.—Wheat, barley, oats, rice, rye, potato, sago, arrow-root, &c.

VII. Mucilaginous.—Carrots, turnips, asparagus, cabbage, &c.

VIII. Saccharine.—The different kinds of sugar, figs, dates, &c.; carrots.

IX. Acidulous.—Oranges, apples, and other acescent fruits.

If there be any truth in our dietetic experience, and any natural affinity between the objects of our classification, the theory of their arrangement will be unimportant; for, however greatly the roads of our pursuit may vary, we must all ultimately arrive at the same end. The danger of relying upon chemistry alone as our guide arises from the uncertainty in which the elementary nature of matter is involved. There can be but little doubt that the supplies by which the bodily waste is recruited are solely derived from the food, for experiments of the most refined nature have shown that no part of the air we breathe is absorbed by the lungs [?]; but it is more than doubtful whether those substances which are considered as the ultimate, or even the proximate, principles of our frame, are supplied to them ready formed by the aliments; or in other words, whether the powers of life do not analyse the matter submitted to them, and by recombining its elements, with which we are probably as yet unacquainted, produce those compounds which the chemist has been induced to suppose have been merely transferred from the ingesta, in order to be incorporated with the living structure. This is not only a highly curious, but a very important question in dietetics. If the views of the chemist be true, we have only to ascertain what principles may be excessive or defective in any state of disease, and at once to adopt a diet that may restore the healthy balance: but plausible and encouraging as such a theory may appear, an appeal to experience will at once prove it to be a delusion. The emaciated invalid can no more be restored to his plump contour by oleaginous ingesta, than the rickety child can be cured of a *mollities ossium* by the administration of phosphate of lime. "Nature," says Dr. Prout, "will not permit the chemist to officiate as her journeyman, even in the most trifling degree; or in other words, he is as little able to remedy or supply, in a direct manner, what is amiss or wanting in organic action, as he is to remedy or supply an injured nerve or muscle; and the only way in which, for the most part, he can hope to influence her operations, is through the indirect agency of those circumstances which naturally possess the power of influencing them, and the management and control of which are, to a certain extent, within his power." (Gulstonian Lecture, 1831.) This admission, however, by no means invalidates the utility of chemical inquiries with regard to the nature of the different articles of diet; for as long as the composition of our diet possesses the power of influencing the constitution of our bodies, it is essential that we should be acquainted with its most minute details.

Amongst the numerous chemico-physiological questions which have arisen in connexion with the subject of dietetics, the late speculations of M. Magendie are not the least curious. It has been asserted by this distinguished physiologist that the azote or nitrogen of all the different tissues of the animal body can only be supplied by our food, and, consequently, that no substance which does not contain this principle can support life. In order to acquire some more exact notions on this subject, he submitted several animals, during a necessary period, to the use of food of which the chemical composition was accurately ascertained. We shall present our readers with a short abstract of these experiments, and then explain the different, but not less important, conclusions which we are prepared to deduce from their results. He took a dog of three years old, fat, and in good health, and put it to feed upon sugar alone, and gave it distilled water to drink: no restrictions were imposed as to quantity. It appeared very well in this way of living for the first seven or eight days; it was brisk, active, ate eagerly, and drank in its usual manner. It began to get thin in the second week, although its appetite continued good, and it took about six or eight ounces of sugar in twenty-four hours. Its alvine excretions were neither frequent nor copious; that of urine was very abundant. In the third week its leanness increased, its strength diminished, the animal lost its liveliness, and its appetite declined. At this period there was developed, first upon one eye, and then on the other, a small ulceration on the centre of the transparent cornea; it increased very quickly, and in a few days was more than a line in diameter; its depth increased in the same proportion; the cornea was very soon entirely perforated, and the humours of the eye ran out. This singular phenomenon was accompanied with an abundant secretion of the glands of the eyelids. The dog, however, became weaker and weaker; and, though it ate from three to four ounces of sugar per day, it became so weak that it could neither chew nor swallow; for the same reason every other motion was impossible. It expired the thirty-second day of the experiment. M. Magendie opened the animal with every suitable precaution. He found a total want of fat; the muscles were reduced to less than five-sixths of their ordinary size; the stomach and intestines were also much diminished in volume, and strongly contracted. The gall and urinary bladders were distended by their proper fluids, which M. Chevreul was called upon to examine. That distinguished chemist found in them nearly all the characters which belong to the urine and bile of *herbivorous* animals; that is, that the urine, instead of being acid as it is in *carnivorous* animals, was sensibly alkaline, and did not present any trace of uric acid, nor of phosphate. The bile contained a considerable portion of *picromel*, a character considered as peculiar to the bile of the ox, and in general to that of herbivorous animals. The excrements were also examined by M. Chevreul, and were found to contain very little azote, whereas they usually furnish a considerable quantity. M. Magendie considered that such results required to be verified by new experiments; he accordingly repeated them on other dogs, but always with the same conclusions. He therefore considered it proved, that sugar by itself is incapable of supporting dogs. This want of the nutritive quality, however, might possibly be peculiar to sugar; he therefore proceeded to inquire whether other substances, *non-azotised*, but generally considered as nutritive, would be attended with the same consequences. He fed two dogs with olive oil and distilled water, upon which they appeared to live well for about fifteen days; but they afterwards underwent the same series of accidents, and died on the thirty-sixth day of the experiment. In these cases, however, the ulceration of the cornea did not occur. Gum is another substance that is said not to contain azote, but which is considered as nutritive. To ascertain whether it acted like sugar and oil, several dogs were fed exclusively upon it, and the phenomena did not sensibly differ from those above described. An experiment was then instituted with butter, an animal substance which, like the preceding, is considered as not possessing any azote in its composition. The dog was supported by it very well at first; but in about fifteen days it began to lose flesh and to become weak: it died on the thirty-sixth day, although on the thirty-fourth he gave it as much flesh as it would eat, a considerable quantity of which it took for two days. The right eye of this animal presented the ulcerations of the cornea. The opening of the body exhibited the same modifications of the bile and urine.

In order to make the evidence furnished by the above experiments as complete as possible, after having given to dogs separately, oil, sugar, or gum, he opened them, and ascertained that these substances were each reduced to a particular chyme in the stomach, and that they afterwards furnished an abundant chyle; whence he argues that, if these different substances are not nourishing, it cannot be attributed to the want of digestion.

We are anxious to give all due credit to the accuracy with which these experiments were performed, but we deny the conclusions which this eminent physiologist has deduced from their results. We meet him at once, by questioning the truth of his very first proposition, that sugar, oil, and gum cannot furnish azote. Is there a chemist of the present day who does not believe, although he is unable to prove it by direct experiment, that azote is a compound? The sugar therefore may furnish its elements, although we cannot detect azote during its decomposition in our laboratories. But let us waive this objection; we are quite prepared to impugn his conclusion on other grounds. What do his experiments prove? In the first place, the fact which we have before stated,—that an animal cannot bear a sudden and permanent change in its diet without injury; and in the next place, that a highly concentrated diet, or food which does not contain an intermixture of innutritive parts, is always injurious.

M. Magendie has himself, by subsequent experiments, furnished evidence against his own theory; for a dog confined on a diet of white bread, the gluten of which contains an abundance of azote, perished like those fed on sugar or gum. Animals, moreover, which were kept upon cheese, and even upon hard boiled eggs, became diseased, and yet *casein* is a highly azotised principle, while albumen is considered by Berzelius as the peculiar source of all the animal secretions.*

[That the effects were not owing to the privation of azote, Magendie has of late been still more amply satisfied. (*Comptes Rendus*, Août, 1841.) In the name of a committee appointed to inquire into the nutritive properties of gelatin, he reported, as chairman, that gelatin, albumen, and fibrin — all of which are highly azoted — when taken separately, nourish animals for a very limited period only, and in an imperfect manner. They generally soon excite such insurmountable disgust, that the animals die rather than partake of them. These experiments have led to the too hasty conclusion, that the gelatinous tissues are incapable of conversion into blood. "The gelatinous substance," says Liebig, (*Animal Chemistry*, Amer. edit. by Webster, p. 124, Cambridge 1842,) "is not a compound of protein: it contains no sulphur, no phosphorus, and it contains more nitrogen or less carbon than protein. The compounds of protein, under the influence of the vital energy of the organs which form the blood, assume a new form, but are not altered in composition; whilst these organs, as far as our experience reaches, do not possess the power of producing compounds of protein, by virtue of any influence, out of substances which contain no protein. Animals, which were fed exclusively on gelatin, the most highly nitrogenized element of the food of carnivora, died with the symptoms of starvation." "In short," he adds, "the gelatinous tissues are incapable of conversion into blood." Yet, it has been shown above, that fibrin and albumen—both compounds of protein — when exhibited alone to animals, nourished them as imperfectly as gelatin.

The experiments of Magendie show the necessity for variety of food for prolonged animal health and existence. Much, doubtless, depends on the habits of the particular animal or individual, and on the morbid effects excited by completely modifying the function of assimilation, as it has been ordinarily practised. It has been long known, that if a person, previously habituated to both animal and vegetable diet, be restricted to one or other exclusively, he will fall off, and become scorbutic; and yet he is capable of subsisting upon either, provided he be restricted to it from early infancy.

Of late, great light has been thrown on this subject by the researches of the organic chemist. These have shown, that the chief proximate principles of animal tissues, and those that have been regarded as highly nutritious amongst vegetables, have almost identically the same composition. (Liebig, *op. cit.*, p. 100.) They all contain nitrogen, or are "nitrogenized." The following tables from Liebig exhibit this similarity of constitution in a striking manner :—

Animal Proximate Principles, according to Mulder.

	Albumen.	Fibrin.	Casein.
Carbon, ...	54.84	54.56	54.96
Hydrogen, ...	7.09	6.90	7.15
Nitrogen, ...	15.83	15.72	15.80
Oxygen, ...	21.23	22.13	21.73
Sulphur, ...	0.68	0.33	0.36
Phosphorus, ...	0.33	0.36	
	100.00	100.00	100.00

Vegetable Proximate Principles, according to Scherer and Jones.

	Albumen, from wheat.	Fibrin.	Casein or Legumin.
Carbon, ...	55.01	54.603	54.138
Hydrogen, ...	7.23	7.302	7.156
Nitrogen, ...	15.92	15.809	15.672
Oxygen, Sulphur, Phosphorus,	21.84	22.286	23.034
	100.00	100.000	100.000

It has been maintained by Liebig and by others, that nitrogenized or azoted aliments are alone capable of forming organized tissues. These, consequently, have been classed by Liebig as *plastic elements of nutrition;* whilst non-nitrogenized aliments being, in his opinion, inservient only to respiration, are termed by him *elements of respiration.* All this, however, requires proof, and is combated by what we observe in chylefication. In the small chyliferous vessels, more fat, which is non-nitrogenized, is contained than can be accounted for by the fat in the food; and as the chyle proceeds, the proportion of fat becomes less and less, whilst that of the nitrogenized elements increases; hence, nitrogen must be obtained, and a conversion, doubtless, takes place of non-nitrogenized into nitrogenized elements.]

We have said that a certain volume or bulk seems to be a necessary condition of wholesome food; — does not the capacity of the digestive organs sufficiently show that Nature never intended them for the reception of highly-concentrated food? This truth is still further exemplified by the very sparing manner in which she produces concentrated aliment; the saccharine matter of esculent fruits is generally blended with acidulous and mucilaginous ingredients, and the oleaginous matter is thus combined with the farinaceous, in seeds, kernels, and other substances of this description. The evils arising from the use of a too concentrated diet are well known to the physician; and, if we extend our observations to the domestic animals under our care, we shall derive further evidence of this important fact. A great number of our horses are fed with oats and beans, the nutriment of which is condensed into a much smaller space than it could generally be in natural provender; and these animals, when supported on such food, are consequently liable to various ailments originating from diseased action in the stomach, or from general plethora; in short, it need scarcely be remarked that horses so fed, and unnaturally confined in stables, require to be bled and purged to preserve their lives. The animal thus abused evidently suffers from acidity, as we find him frequently eating absorbent earths with avidity.* The extraordinary exertions often required of horses render it necessary that they should be better fed than when existing in a more natural state; and since they do not travel so well with a full stomach, it is also necessary to adopt the use of food in which the nutriment is reduced into the smallest compass. Post-horses and others, whose motion must be rapid, are therefore chiefly fed with corn alone; but what is the effect?—fermentation instead of digestion; as the intolerable odour which assails us in the stable, under such circumstances, and the decomposed glass of its windows from the sulphuretted hydrogen acting upon the lead contained in it, sufficiently testify. Did it never occur to the physiologist, that had Nature intended animals to feed only upon the concentrated aliment of gramineous and leguminous vegetables, she would have supplied them with an apparatus by which they might separate the chaff and straw from the grain?

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* The ingenious experiments of Mr. Hatchett also show that albumen is the *parent* fluid from which other principles may be formed; he found, for instance, that it was convertible into gelatine and fibrine.—*Phil. Trans.* 1800.

These remarks may be applied to man: we shall have occasion to show hereafter that the use of chocolate, butter, cream, sugar, and rich sauces, without a due admixture of bread, potatoes, and other less concentrated aliment, is invariably attended with disordered digestion. Unless the taste be vitiated, there exists an instinctive aversion to such food—

> ——————— "the prudent taste
> Rejects, like bane, such loathsome lusciousness."

The Kamtschatdales are frequently compelled to live on fish-oil, but they judiciously form it into a paste with saw-dust, or the rasped fibres of indigenous plants.

Nutritiveness and Digestibility of different kinds of Food.—Before we attempt to appreciate the value of the different articles of the materia alimentaria, it will be necessary to caution the reader against the popular error of regarding the terms digestible and nutritive as synonymous and convertible. A substance may be highly nutritive and yet be digested with difficulty; that is to say, it may require all the powers of the digestive organs to convert it into chyle, and yet, when so converted, it may afford a principle of highly restorative energy: this is the case with the fatty and oily elements.† On the contrary, there are substances which apparently pass out of the stomach with sufficient readiness, but afford but little comparative support to the body.

Writers on dietetics have descanted very learnedly upon what they please to term the *perspirability* and *alkalescency* of certain aliments. To the former we are quite unable to attach any precise meaning; with respect to the latter, we apprehend that it is intended to express a highly nutritive quality, with a certain degree of indigestibility. *Heavy* and *light*, as applied to food, are terms equally vague and indefinite, and ought never to be introduced into writings which aspire to the character of philosophical precision. The observation may be extended to the epithet *bilious*.

It is only necessary to reflect upon the chemical and mechanical processes by which chymification is performed in the stomach, to perceive that the digestibility of a substance may depend upon other circumstances than that of its chemical composition. Its mechanical state with regard to texture and consistence, is of the highest importance; and if we attempt to deduce any law upon this subject, from the known solubility of a substance out of the body, we shall fall into several fatal errors. It will be necessary to investigate this question with some attention, for it not only explains the relative digestibility of aliments, but furnishes the only true basis for a system of skilful cookery.

The healthy stomach disposes most readily and effectually of solid food, of a certain specific degree of density, which may be termed its *digestive texture*; if it exceed this, it will require a greater length of time and more active powers to complete its chymification; and if it approaches too nearly to a gelatinous condition, the stomach will be equally impeded in its operations. It is, perhaps, not possible to appreciate or express the exact degree of firmness which will confer the highest order of digestibility upon food;‡ indeed this point may vary in different individuals; but we are taught by experience that no meat is so digestible as tender mutton: when well-conditioned, its fibre appears to possess that degree of consistence which is most congenial to the stomach; and in this country it is perhaps more universally used than any other animal food. Wedder mutton, or the flesh of the castrated animal, is in perfection at five years, and is by far the sweetest and most digestible. Ewe mutton is best at two years old. Beef appears to be not so easy of digestion; its texture is firmer, but it is equally nutritive; much, however, will depend upon the period which has elapsed since the death of the animal, and more upon the method of cookery; in short, it would be worse than useless to attempt the construction of any scale to represent the nutritive and digestive qualities of the different species of food: the observations here introduced are merely noticed for the sake of illustrating those general principles whose application can alone afford us any rational theory of diet.

It will not be difficult to understand why a certain texture and coherence of the aliment should confer upon it digestibility or otherwise. Its conversion into chyme is effected by the solvent power of the gastric juice, aided by the *churning* which it undergoes by the motions of the stomach; and unless the substance introduced possesses a suitable degree of firmness, it will not yield to such motions: this is the case with soups and other liquid aliments; in such cases, therefore, nature removes the watery part before digestion can be carried forward. It is on this account that oils are digested with so much difficulty; and it is probable that jellies and other glutinous matters, although containing the elements of nourishment in the highest state of concentration, are not digested without considerable difficulty; in the first place, on account of their evading the grappling powers of the stomach, and, in the next, in consequence of their tenacity opposing the absorption of their more fluid parts. For these reasons the addition of isinglass and other glutinous matter to animal broths, with a view to render them more nutritive to invalids, is a questionable custom.

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* The habit of crib-biting may perhaps be attributed to such a source.

† It has been calculated that an ounce of fat meat affords nutriment equal to four ounces of lean.

‡ Some experiments were introduced for this purpose by Gosse, of Geneva; but the conclusions deduced from them are by no means satisfactory. He confounds solubility with digestibility, which in itself is sufficient to vitiate his reasoning.

The texture of animal food is greatly influenced by the age, sex, habits, condition, diet, and description of death of the animal which furnishes it. In proportion generally to the age, its flesh is coarser and more firm in texture, as every one must have noticed in eating birds. If the flesh of mutton and lamb, beef and veal, are compared, they will be found of a different texture; the two young meats are of a more stringy, indivisible nature than the others, which makes them harder of digestion. It has been also justly observed that young animals differ from old ones in the distribution of the fat, which in the latter is chiefly collected in masses or layers, external to the muscles; whereas in the former it is more interspersed among the muscular fibres, giving the flesh a marbled appearance, which is always a desirable property of butchers' meat. The texture of food will also vary according to the wild or domesticated state of the animal; that of the former is more dense, although highly nutritive. The sex also modifies the quality of the flesh, that of the female being always more delicate and finer-grained than that of the entire male, whose fibres are denser. The influence of the genital organs upon this occasion is very extraordinary; it is generally believed that the flavour of the female is even improved by removing the ovaries, or *spaying* them, as it is called. Every day the testes are permitted to remain, even though totally inactive with regard to their proper functions, injures the delicacy of the veal of the bull calf; and an animal which is not castrated until after puberty always retains much of the coarseness of the entire male. The mode of killing an animal has been considered, from the remotest ages, as capable of affecting the quality of its meat. The flesh of hunted animals is characterized by peculiar tenderness: the same effect is produced by any lingering death. This fact probably explains the policy of those old municipal laws which ordained that no butcher should offer or expose any bull-beef for sale unless it had previously been baited; and it is upon the same principle only that the quality of pig's flesh could be improved by the horrid cruelty of whipping them to death, as said to be practised by the Germans. The action of vinegar, administered to an animal some hours before killing it, is also known to be capable of rendering its flesh less tough. It is a common practice in the country to give a spoonful of this acid to poultry, when they are intended for the immediate service of the table.

Nothing, however, tends more effectually to ameliorate the rigidity of the animal fibre than incipient putrefaction. The length of time that meat ought to be kept after it is killed will necessarily depend upon its tendency to undergo the putrid fermentation, and the prevalence of those circumstances which are inclined to favour it.

The circumstances which have been just enumerated, as being capable of influencing the texture of our food, and consequently its degree of digestibility, are, however, unimportant when compared with the modifying powers of cookery, which we shall now proceed to examine.

Cookery.—By cookery, alimentary substances undergo a two-fold change; their principles are *chemically* modified, and their textures *mechanically* changed. The extent and nature, however, of these changes will greatly depend upon the manner in which heat has been applied to them; and if we inquire into the culinary history of different countries, we shall trace its connection with the fuel most accessible to them. This fact readily explains the prevalence of the peculiar species of cookery which distinguishes the French table, and which has no reference, as some have imagined, to the dietetic theory or superior refinement of the inhabitants.

By the operation of *boiling*, the principles not properly soluble are rendered softer, more pulpy, and, consequently, easier of digestion; but the meat, at the same time, is deprived of some of its nutritive properties by the removal of a portion of its soluble constituents: the albumen and gelatin are also acted upon; the former being solidified, and the latter converted into a gelatinous substance. If, therefore, our meat be boiled too long or too fast, we shall obtain, where the albumen predominates, as in beef, a hard and indigestible mass, like an over-boiled egg; or where the gelatin predominates, as in young meats, such as veal, a gelatinous substance equally injurious to the digestive organs. Young and viscid food, therefore, as veal, chickens, &c., is more wholesome when roasted than when boiled, and is easier digested. Dr. Prout has very justly remarked that the boiling temperature is too high for a great many of the processes of cooking, and that a lower temperature and a greater time, or a *species of infusion*, are better adapted for most of them. This is notorious with substances intended to be *stewed*, which, even in cookery-books, are directed to be *boiled slowly*, (that is, not at all,) and for a considerable time.* The ignorance and prejudice existing on these points is very great, and combated with difficulty; yet, when we take into account their importance, and how intimately they are connected with health, they will be found to deserve no small share of our attention. The loss occasioned by boiling partly depends upon the melting of the fat, but chiefly from the solution of the gelatin and osmazone; mutton generally loses about one-fifth, and beef about one-fourth, of its original weight. Boiling is particularly applicable to vegetables, rendering them more soluble in the stomach, and depriving them of a considerable quantity of *air*, so injurious to weak stomachs. But, even in this case, the operation may be carried to an injurious extent; thus potatoes are frequently boiled to the state of a dry insipid powder, instead of being preserved in that state in which the parts of which they are composed are rendered soft and gelatinous, so as to retain their shape, and yet be very easily separated. On the other hand, the cabbage tribe and carrots are frequently not boiled long enough, in which state they are highly indigestible. In conducting this process it is necessary to pay some attention to the quality of the water employed; thus, mutton boiled in hard water is more tender and juicy than when soft water is used; while vegetables, on the contrary, are rendered harder and less digestible when boiled in hard water.

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* Hence it is that beef-tea and mutton-tea are much more calculated for invalids than the broths of these meats.

By the process of *roasting*, the fibrine is corrugated, the albumen coagulated, the fat liquefied, and the water evaporated. As the operation proceeds, the surface becomes first brown, and then scorched, and the tendinous parts are rendered softer and gluey. Care should always be taken that the meat should not be *over-done*, nor ought it to be *under-dressed;* for although in this latter state it may contain more nutriment, yet it will be less digestible, on account of the density of its texture. This fact has been satisfactorily proved by the experiments of Spallanzani; (Spallanzani on Digestion, vol. i. p. 277;) and Mr. Hunter observes that "*boiled*, and *roasted*, and even *putrid* meat, is easier of digestion than that which is raw." (Hunter on the Animal Economy, p. 220.) Animal matter loses more by roasting than by boiling; it has been stated above, that by this latter process mutton loses one-fifth, and beef one-fourth; but by roasting, these meats lose about one-third of their weight. In roasting, the loss arises from the melting out of the fat, and the evaporation of the water; but the nutritious matter remains condensed in the cooked solid; whereas, in boiling, the gelatine is partly abstracted. Roasted are, therefore, more nutritive than boiled meats.*

The process of *frying* is, perhaps, the most objectionable of all the culinary operations. The heat is applied through the medium of boiling oil, or fat, which is thus rendered empyreumatic, and therefore extremely liable to disagree with the stomach.

By *broiling*, the sudden browning or hardening of the surface prevents the evaporation of the juices of the meat, which imparts a peculiar tenderness to it. It is the form selected, as the most eligible, by those who seek to invigorate themselves by the art of *training*.

The peculiarity of the process of *baking* depends upon the substance being heated in a confined space, which does not permit the escape of the fumes arising from it; the meat is therefore, from the retention of its juices, rendered more sapid and tender. But baked meats are not so easily digested, on account of the greater retention of their oils, which are, moreover, in an empyreumatic state. Such dishes accordingly require the stimulus of various condiments to increase the digesting powers of the stomach.

[SOLID] ARTICLES OF DIET.—Were we to follow the steps of preceding writers on dietetics, we should present a catalogue of the nutrientia, and introduce under each article a history of its composition and qualities; but the utility of general principles is to abbreviate labour, and to class under distinct heads those remarks which were previously scattered and unconnected.

We have seen that the nutritive qualities of a substance depend upon its composition; but that its digestibility may be influenced by various mechanical causes. It is by such tests that we have now to examine the several classes of food, and to assign to the individual bodies which they embrace their relative value as articles of diet.

Milk is the only nutritive fluid with which nature has presented us; but if we examine its chemical composition, we shall soon discover that it possesses an ingredient which is instantly coagulated in the stomach: so that, in fact, it must be regarded as a mixture of solid and liquid aliment; the latter, however, considerably exceeding the former in quantity, and thereby demonstrating the necessity of a greater portion of fluid than of solid matter, on which the necessity of alimentary supplies is founded.

Although recent milk appears as a homogeneous liquid, it may be resolved, partly by standing, and partly by agents that do not essentially alter the nature of its components, into three proximate ingredients, the *cream*, *curd*, and *whey*.

1. The **cream** rises to the surface of the milk, after it has stood for some hours, and may be skimmed off, and thus separated from it. It appears to possess many of the properties of oil, is smooth and unctuous to the touch, and stains cloth in the same manner as other unctuous substances. By standing for some days it becomes gradually thicker, and at length forms a soft solid, in which the flavour of cream is no longer perceived, and that of cheese is substituted in its place. According to the experiments of Berzelius, cream is a compound body, consisting of butter, 4·5; cheese, 3·5; and whey, 92 parts; but since the whey holds certain salts in solution, we may consider the whole of the solid matter contained in cream as amounting to 12·5 per cent. When cream is agitated, as is done by the common process of churning, it is separated into two parts; a thick animal oil, well known by the name of butter, and a fluid which possesses exactly the same properties as milk that has been deprived of its cream. This change has been supposed to be owing to the combination of the cream with the oxygen of the atmosphere; but it takes place, though perhaps not equally well, in vessels from which the air has been excluded.

2. When milk, either deprived or not of its cream, is mixed with certain substances, or allowed to stand till it becomes sour, it undergoes a change which is called coagulation, consisting of its separation into a solid substance termed **curd**, and a fluid called *whey*. This change may be effected by several agents, such as alcohol, gelatine, and all astringent vegetables; by acids and many neutral salts; by gum, sugar, and more particularly by the *gastric juice*. The effect is supposed to arise from the affinity of the coagulating substance for water, the curd. being principally albumen, having very little affinity for the same; but this theory can hardly explain the operation of the gastric juice: the infusion of a piece of calf's stomach, not larger than a half crown, will coagulate a quantity of milk sufficient for making a cheese of sixty pounds weight, although the quantity of coagulating matter cannot in this case exceed a few grains.

3. **Whey**, or the liquid which remains after the separation of the curd, is a thin and almost transparent fluid, of a yellowish-green colour, and

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* It has been computed that, from the dissipation of the nutritive juices by boiling, one pound of *roasted* contains as much nourishment as two of boiled meat.

a pleasant sweetish taste. It still contains, generally, a portion both of curd and of butter; the former of which may be separated by a boiling heat, in the form of coagulum. The buttery matter also separates by heat, especially if the whey be previously allowed to become sour. Whey contains, indeed, in its recent state, some acetic acid. When whey, which has been deprived as much as possible of the butter and curd, is slowly evaporated, it yields the peculiar substance termed "*sugar of milk,*" which may be obtained, by clarification with the whites of eggs, in the form of crystals. The presence of the saccharine matter held in solution in whey enables that fluid to undergo the vinous fermentation; and it is accordingly employed by the Tartars for making a sort of wine, which is called *Koumiss.* For this purpose mare's milk is selected, as containing a larger portion of sugar than that of the cow. Whey also contains several saline bodies, viz., *muriate of potass, phosphates of lime and of iron,* and *sulphate of potass;* and a peculiar *animal matter,* which gives a precipitate with infusion of galls, and affords carbonate of ammonia by distillation.

Although nature has presented us with this compound fluid for the purposes of nourishment, and although it is evident that its several ingredients are wholesome, and designed for the various objects of aliment, yet, when separated by art, they are frequently unwelcome to the stomach; that viscus would appear to dislike the interference of the cook, in the performance of an analysis which its own powers are so well calculated to effect. We are well assured that the first process which takes place in the stomach for the chymification of milk, is its separation into curd and whey; and yet the former of these substances, when obtained by art, frequently proves highly oppressive to the stomach, and sometimes occasions obstructions in the bowels. **Cheese,** again, which is nothing more than the coagulum of milk, pressed, salted, and partly dried, with a portion of butter, which, having been enveloped in the curd, is not afterwards separable, is one of the least digestible of our aliments, and is only adapted to strong stomachs, and to such persons as use great and constant exercise. When *toasted,* it is still more injurious, from acquiring a tenacity of texture highly hostile to the digestive functions of the stomach. **Butter,** from its oily nature, is apt to disagree with delicate stomachs, and when rendered empyreumatic by heat, produces heartburn and other distressing symptoms. Whey differs considerably in its dietetic value, according to the method employed for its separation. When this is effected by *rennet,* it always holds a portion of cream and curd suspended in it, besides its quantity of sugar. It is, therefore, considerably nutritive; but it is, at the same time, more acescent than milk, and hence it is liable to produce flatulence in those whose stomachs are disposed to encourage fermentation. Whey that has been produced by spontaneous coagulation always contains less nutritive matter, is more acid, and consequently more objectionable, unless, perhaps, as a drink in certain states of fever.

From this account of the composition of milk, several properties of the entire fluid may be understood. By boiling it, its albuminous part is not coagulated into a mass like the white of an egg, on account of the large quantity of water through which it is diffused; but a thin pellicle forms on the surface, which, if removed, is immediately replaced by another; and thus the whole of the albumen may be separated in successive portions. The effect of this process is therefore to diminish the nutritive quality of the milk; but it may at the same time render it more easily digestible. We have known many invalids who could take boiled milk, but were unable to bear that fluid in its natural state.

Milk, in its dietetic relations, may be considered as intermediate between animal and vegetable food; it is easily assimilated, and therefore affords a quick supply of aliment to the system, while it does not excite that degree of vascular action which is produced by other animal matters. Its nutritive powers may be increased by various additions, which have also, on some occasions, the effect of correcting its natural tendency to acidity, and on others, that of obviating the costiveness which it is liable to occasion; such objects are sometimes fulfilled by adding oatmeal gruel to it. In certain states of organic disease, we have found that milk, impregnated with the fatty matter of mutton-suet, is a valuable article of diet: such a repast is best prepared by inserting the suet in a muslin bag, and then simmering it with the milk.

Before quitting this subject, it is necessary to observe that there exists some difference in the composition of the milk of different animals. That of the human subject is much thinner than cow's milk; is of a bluer colour, and contains much more saccharine matter. It also yields a larger proportion of cream, but from which the butter cannot be separated by agitation. It deposits a part of its curd by mere repose. Asses' milk bears a stronger resemblance to human milk than to any other; it contains more sugar than that of the cow, and the proportion of curd is so considerable as even to separate on standing, before the milk becomes sour. Goat's milk yields a remarkably thick and unctuous cream, and abounds also in curd.

Eggs, in point of nutriment and digestibility, may be classed next to milk; but their qualities will greatly depend upon the manner in which they have been cooked. When raw, they are certainly not so easily digested as when lightly boiled, so as slightly to coagulate their albuminous principle: but if this process be carried too far, they are converted into a hard mass, which requires a long period for their digestion: but this is much accelerated by the use of vinegar as a condiment. They are distinguished by the peculiar quality of singularly affecting some stomachs, even in the smallest quantity; while they do not produce any uneasy impressions on others. We are acquainted with a person who constantly finds an egg to produce uneasiness when his stomach is in the least deranged, but who can eat them with impunity at all other times. It is a notorious fact that eggs, when raw, are laxative, and when cooked are apt to produce costiveness.

Fish has been generally considered as holding a middle rank between the flesh of warm-blooded animals and vegetable food. It is certainly less nutritive than mutton or beef; but the health and vigour of the inhabitants of fishing-towns evidently prove that it is sufficiently nourishing for all the purposes of active life: but in order to satisfy the appetite, a large quantity is requisite; and the appetite returns at shorter intervals than those which occur during a diet of meat. Nor does this species of food produce the same stimulus to the body; the pulse is not strengthened as after a repast of flesh; and that febrile excitement which attends the digestion of the more nutritive viands is not experienced. Hence fish affords a most valuable article of diet to invalids labouring under particular disorders; for it furnishes a chyle moderately nutritive, but at the same time, not highly stimulant. From the nature of its texture, it does not require a laborious operation of the stomach; although it is sufficiently solid to rescue it from those objections which have been urged against liquid or gelatinous food. From the observations just offered upon the nutritive powers of fish, it must follow that such a diet is not calculated to restore power to habits debilitated by disease, and should never be directed under such circumstances, but from the conviction that the digestive powers are unable to convert stronger aliment into chyle. The jockeys who *waste themselves* at Newmarket in order to reduce their weight, are never allowed meat when fish can be obtained. On account of the low stimulant power of fish, it requires the assistance of condiment; and on this account salt appears to be an essential accompaniment.

Fish have been arranged under three divisions, viz., *fresh-water fish*, *salt-water fish*, and *shell-fish*; but, since the value of these animals as articles of food has an intimate relation to the colour and texture of their muscles, and to their gelatinous or oily qualities, it will be expedient to consider their several varieties with reference to such conditions. Turbot, cod, whiting, haddock, flounder, and sole, are the least heating of the more nutritive species; and the flakiness of the fish, and its opaque appearance after being cooked, may be considered as true indications of its goodness; for when the muscles remain semi-transparent and bluish, after sufficient boiling, we may reject it as inferior in value, or not in season. When the fish is in high perfection, there is also a layer of white curdy matter, resembling coagulated albumen, interposed between its flakes. The whiting is well adapted to weak stomachs, on account of the little viscidity which it possesses; it is, at the same time, tender, white, and delicate, and conveys sufficient nutriment with but little stimulus to the system. The haddock much resembles it, but is firmer in texture. Cod has a more dense fibre than the two former, and contains also more glutinous matter: it is an excellent aliment, but upon the whole is not quite so digestible as whiting or haddock. It is generally preferred when large; but such fish are frequently coarse. The haddock is certainly better when it does not exceed a middling size. Turbot is an excellent article of food; but it is usually rendered difficult of digestion by the quantity of lobster sauce with which it is eaten. Sole is tender, and yet sufficiently firm; it is therefore easy of digestion, and affords proper nutriment to delicate stomachs. It is necessary to state that every part of the same fish is not equally digestible; and it unfortunately happens that those which are considered the most delicate are, at the same time, the most exceptionable: the pulpy, gelatinous skin of the turbot, and the glutinous parts about the head of the cod, are very apt to disagree with invalids. Salmon may, perhaps, be considered the most nutritive of our fish; but it is heating and oily, and not very digestible: and persons, even with strong stomachs, are frequently under the necessity of taking some stimulant to assist its digestion. The addition of lobster sauce renders it still more unwholesome: the best condiment that can be used is vinegar. As connected with the time of spawning, the season of the year has the most decided influence upon the quality of salmon. It is in the highest perfection, or *in season*, as it is termed, some time previous to its spawning; the flesh is then firm and delicious; whereas, after this event, it is for some time unfit for food. Salmon trout is not so rich and oily as the salmon; although, therefore, it is less nutritive, it is at the same time less heating and more digestible. Eels are extremely objectionable, on account of the large proportion of oil which they contain. From these observations, the value of fish may be appreciated, and the qualities which entitle them to election easily understood. Firmness of texture, whiteness of muscle, and the absence of oiliness and viscidity are the circumstances which render them acceptable to weak stomachs.

Shell-fish have been greatly extolled by some physicians as nutritive and easily digestible articles of food. It will be necessary to examine this question by the application of those principles which we have endeavoured to establish. Oysters would appear to enjoy a reputation which they do not deserve; when eaten cold they are frequently distressing to weak stomachs, and require the aid of pepper as a stimulant; and since they are usually swallowed without mastication, the stomach has an additional labour to perform, in order to reduce them into chyme. When cooked they are still less digestible, on account of the change produced upon their albuminous principle. It is, however, certain that they are nourishing, and contain a considerable quantity of nutritive matter in a small compass. It is equally clear that oysters have occasionally produced injurious effects, (Medical Transactions of the College of Physicians, vol. v.); these have been attributed to their having lain on coppery beds, but this idea is entirely unfounded, and arose merely from the green colour which they often acquire, the cause of which is now generally understood, being sometimes an operation of nature, but more generally produced by art, by placing them in a situation where there is a great deposit from the sea, consisting of the vegetable germs of marine *conferræ* and *fuci*, and which impart their colour to the oyster. For this object the Dutch formerly carried oysters from our coasts, and deposited them on their own. Native oysters, transported into the Colchester beds, soon assume a green colour. Where this food has produced a fit of indigestion, it has evidently arisen from the indigestible nature of the oyster, and the state of the individual's stomach at the time; and had such a person indulged to the same amount in any equally indigestible aliment, there can be no doubt but that he would have experienced similar effects. Oysters cast their spawn, which the dredgers call the *spat*, in the month of May, after which they are sick and unfit for food; but in June and July they begin to mend, and in August they are perfectly well. We therefore see the cause of their going out of season, and discover the origin of the old maxim, that an oyster is never good except when there is an *r* in the month. Lobsters are certainly nutritive; but they are exposed to the same objection on the ground of indigestibility; and such has been their effect upon certain stomachs, as to have excited a suspicion of their containing some poisonous principle: they have been known to occasion pain in the throat, and, besides eruptions upon the skin, to extend their morbid influence to the production of pain in the stomach, and affection of the joints. As found in the London market, they are generally underboiled, with a view to their better keeping; and in that case they are highly indigestible. The same observations apply to the crab. Shrimps are a species of sea crab, which vary in their colour and size, and are considered easier of digestion than the preceding articles. The mussel is a species of bivalve which is more solid, and quite as indigestible as any animal of the same tribe. The common people consider them as poisonous, and, in eating them, take out a part in which they suppose the poison principally to reside. This is a dark part, which is the heart, and is quite innocuous: the fact, however, is sufficient to prove that this species of bivalve has been known to kill; but probably not more frequently than any other indigestible substance. Our annals abound with instances of the deleterious properties of melon, cucumbers, &c. and yet no one will contend that any poison, properly so called, resides in such vegetables. The peculiar cutaneous efflorescence which is produced by the imperfect digestion of shell-fish, has been observed to occur more frequently in cases where the fish has been stale or tainted, although it also happens where no such error can be suspected.

It has been usual to attribute all the cutaneous affections which follow the liberal use of fish as depending upon the sympathy of the skin with the stomach. This, we believe, is in general the true explanation, since the effect is merely temporary; and when the process of digestion is finished, it departs. Its departure may even be hastened by the operation of an emetic removing the noxious aliment. At the same time the fact must not be overlooked, that the oily principle upon which depends the odour of certain fish, is absorbed from the alimentary canal, and carried into the blood; this is evident from the peculiar flavour of the flesh of certain birds which live upon fish. It is also well known that persons confined for any length of time to a diet of fish secrete a sweat of a rancid smell. It is not, therefore, improbable that certain cutaneous diseases may be produced, or at least aggravated, by such diet; and in hot climates this effect may be less questionable. The priests of Egypt may therefore have been prohibited from eating fish upon just principles, in order that the leprosy might be averted; and the great legislator of the Jews was, no doubt, influenced by some such belief, when he framed his celebrated prohibition. (Leviticus, xi. 9—12.)

It is usual to add various condiments to fish, and many kinds of fish are doubtless thus rendered more digestible, by a necessary stimulus being afforded to the stomach; but rich sauces are ever to be avoided by the valetudinarian. Vinegar and salt, perhaps, form the best additions.

The mode of cooking fish is another circumstance of some importance. Frying them in lard or oil is an objectionable process: in general, the process of boiling is best adapted for rendering them wholesome. Stewed fish, with all the usual additions of glutinous and stimulant materials, are extremely injurious to dyspeptics.

Birds.—There exists a great variety in the qualities of the food which is furnished by this class of animals, with regard to nourishment, stimulus, and digestibility: the whiter meat of domesticated birds, as the wings and breasts of chickens, contains less nutriment, and is less digestible than that which is furnished by wild birds, as the partridge, &c.; but the former is, at the same time, less stimulant and heating than the latter. These are the circumstances which are to direct the medical practitioner in his opinion. No general rule for the choice of either species can be established; it must be determined by the particular condition of the patient, and the effect which the aliment is intended to produce. The same observation will apply to the flesh of quadrupeds; that which is dark-coloured and contains a large proportion of fibrin, as venison, &c. is easily disposed of by the stomach, and a large quantity of highly stimulating chyle is produced from it. The whiter meats are, on the contrary, detained longer in the stomach, and furnish a less stimulant chyle. The former, therefore, will be more easily digested by weak persons, while the latter will frequently run into a state of acetous fermentation; but they may, nevertheless, be preferable on many occasions, inasmuch as they impart less stimulus to the general system. We see, therefore, the folly into which many popular writers have fallen, of stating such or such an article as being wholesome or otherwise; as the wholesomeness of an aliment must depend upon its fitness to produce the particular effect which the case in question may require. Van Swieten has justly said, that "to assert a thing to be wholesome, without a knowledge of the condition of the person for whom it is intended, is like a sailor pronouncing the wind to be fair, without knowing to what port the vessel is bound."

Farinaceous Aliments.—The flour of wheat contains three distinct substances; a *mucilaginous saccharine matter*, *starch*, and a peculiar substance, possessing many of the properties of animal matter, termed *gluten*. It is to the quantity of this latter ingredient that wheat flour possesses so decided a superiority over that of barley, rye, or oats, for from these latter grains much less gluten can be extracted. It furnishes by far the best ingredient for making that important article of diet, *bread;* although it may also be made of all the various sorts of grain, as well as of chesnuts, of several roots, and of the potato. We shall first describe the nature of wheaten bread, and then compare it with that produced from other substances. The first process for rendering farinaceous seeds esculent, is to grind them into powder between mill-stones: the *meal* thus produced is purified from the husk of the seed, or *bran*, by the operation of sifting or *bolting;* and it is then denominated *flour*. This, when mixed with water or milk, undoubtedly possesses the power of nourishing the body; but in this raw state it would not be sufficiently digestible; it would clog the stomach, and oppose those actions which are essential to chymification. The application, however, of heat renders the compound more easy to masticate as well as to digest; whence we find in the earliest history a reference to some process instituted for the purpose of producing this change, although the discovery of the manufacture of bread, simple as it may appear to us, was probably the work of ages. It has been just stated that wheaten flour is the best adapted for making bread, that is to say, *loaf* bread; this depends upon the greater quantity of gluten which it contains, and which operates in a manner to be presently explained. The first stage of this process of *panification* consists in mixing the flour with water, in order to form a paste, the average proportion of which is two parts of the water to three of the flour; but this will necessarily vary with the age and quality of the flour: in general, the older and the better the flour, the greater will be the quantity of water required. This paste may be regarded as merely a viscid and elastic tissue of gluten, the interstices of which are filled with starch, albumen and sugar. If, then, it be allowed to remain for some time, its ingredients gradually re-act upon each other, the gluten probably performing an important part; by its action on the sweet principle, a *fermentation* is established, and alcohol, carbonic acid, and lastly acetic acid, are evolved. If the paste be now baked, it forms a loaf full of *eyes*, like our bread, but of a taste so sour and unpleasant that it cannot be eaten. If a portion of this old paste, or *leaven*, as it is called, be mixed with new-made paste, the fermentation commences more immediately, a quantity of carbonic acid is given off, but the gluten resists its disengagement, expands like a membrane, and forms a multitude of little cavities, which give lightness and sponginess to the mass. We easily, therefore, perceive why flour, deficient in the tenacity which gluten imparts to it, is incapable of making raised bread, notwithstanding the greatest activity may be given to the fermentative process by artificial additions. Where, however, *leaven* has been employed, the bread will be apt to be sour, in consequence of the great difficulty of so adjusting its proportion, that it shall not by its excess impart an unpleasant flavour, nor by its deficiency render the bread too compact and heavy. It is for such reasons that in this country we employ *barm;* a ferment which collects on the surface of fermenting beer. It appears that we are indebted to the ancient Gauls for this practice. In Paris it was introduced about the end of the seventeenth century; the Faculty of Medicine, however, declared it to be prejudicial to health, and it was long before the bakers could convince the public that bread baked with *barm* was superior to that of *leaven*. A great question arose among chemists as to the nature of this *barm* that could produce such effects, and elaborate analyses were made, and theories deduced from their results; but all these ingenious speculations fell to the ground, when it was found that *barm*, dried and made into balls, would answer every purpose; the bakers imported it in such a form from Picardy and Flanders, and when again moistened, it fermented bread as well as the recent substance. The presence, therefore, of carbonic acid, water, acetic acid, and alcohol, could not be essential, for these ingredients were separated by the process of its preparation. At length it was discovered that gluten, mixed with a vegetable acid, produced all the desired effects; and such is the nature of leaven, and such is the compound to which barm is indebted for its value as a panary ferment. After the dough has sufficiently fermented, and is properly raised, it is put into the oven previously heated, and allowed to remain till it is baked. The mean heat, as ascertained by Mr. Tillet, is 448°. When the bread is removed, it will be found to have lost about one-fifth of its weight, owing to the evaporation of water; but this proportion will be varied by the occurrence of numerous circumstances which it is not easy to appreciate. Newly-baked bread has a peculiar odour as well as taste, which are lost by keeping: this shows that some peculiar substance must have been formed during the operation, the nature of which is not understood. Bread differs very completely from the flour of which it is made, for none of the ingredients of the latter can be discovered in it; it is much more miscible with water than dough; and on this circumstance its good qualities, most probably, in a great measure depend. It is not easy to explain the chemical changes which have taken place. It appears certain that a quantity of water, or its elements, is consolidated and combined with the flour; the gluten, too, would seem to form a union with the starch and water, and thus to give rise to a compound upon which the nutritive qualities of bread depend.

Unleavened bread consists of a mixture of meal and water, formed into a firm and tough cake, made as thin as possible, to favour its drying, and sometimes with the addition of butter, to render it more soluble, friable, and porous; but it renders it sourer, and more apt to produce acidity on the stomach. Of the unleavened sorts of bread, biscuit is by far the best; and in all cases where leavened or fermented bread does not agree, its use cannot be too strongly advocated.

The different sorts of bread to be met with in this country may be considered under three classes: viz. *white*, *wheaten*, and *household*. In the first, all the *bran* is separated; in the second, only the coarser; in the third, none at all: so that *fine bread* is made only of flour, *wheaten* bread of flour and a mixture of the finer bran, and *household* of the whole substance of the grain, without taking out either the coarse bran or fine flour. It is necessary for the medical practitioner to understand these distinctions; for it will be proved that an important dietetic fact is connected with them. The tendency of starch upon the bowels is astringent. Bread, therefore, which is made of the whitest flour is apt to render them costive; but this is counteracted by the presence of *bran*, the scales of which appear to exert a mechanical influence upon the intestines, and thus to excite them into action.

The French have many varieties of bread, in which eggs, milk, and butter enter as ingredients. They are also in the habit of adding ammonia to the dough; which, during its evaporation in the oven, raises it, and thus adds to its sponginess.

Barley-bread has a sweetish but not an unpleasant taste; it is, however, rather viscid, and is less nutritive, as well as less digestible, than wheaten bread. It is common to mix peas-meal with the barley, which certainly improves the bread. *Rye-bread* is of a dark brown colour, and is apt to lie heavy on the stomach; it is also liable to create acescency and purging; but it appears to be highly nutritive. In some of the interior counties of England, where their bread is often manufactured from oatmeal, there is a mode of preparing the meal by making it sour; the bread, instead of being hard, is thus rendered of a soft texture, and from its moderate acidity is wholesome to strong persons: but invalids should, if possible, avoid it. In bread, however, this grain is more usually in an unfermented state, or it is made into flat, thin cakes, which are baked or roasted. It is evident, from the health and vigour of the people who use this grain as a principal article of diet, that it must be very nutritive; but the stomach will require some discipline before it can digest it. In those unaccustomed to such food, it produces heartburn; and it is said to occasion, even in those with whom it agrees, cutaneous affections. In times of scarcity, potatoes have been made into bread; but they contain too much mucilage in proportion to their starch to afford a good article: the bread thus produced is heavy, and apt to crumble into powder; effects which are obviated by mixing a certain quantity of wheat-flour with the potatoes. Rice will also serve the purpose of making very good bread; but, like the potato, it requires the addition of some flour. It is said by some that bread made of different kinds of grain is more wholesome than that made of only one sort, as their qualities serve to correct one another. This is certainly the case with that which is commonly called *brown* bread, and which is made of a mixture of wheat and rye flour; the former, being of a more starchy nature, and apt to produce costiveness, while the latter often proves too laxative: a due proportion of each, therefore, must furnish a desirable compound.

The importance of bread, as an article of diet, will be easily deduced from the principles upon which the digestion of food in the stomach is explained. In addition to its nutritive qualities, it performs a mechanical duty of some importance. It serves to divide the food, and to impart a suitable bulk and consistence to it; it is, therefore, more necessary to conjoin it with articles containing much aliment in a small space, than where the food is both bulky and nutritive. The concentrated cookery of the French is rendered much more wholesome from the large quantity of bread which that people use at their meals. Bread should never be eaten new; in such a state, it swells like a sponge in the stomach, and proves very indigestible. Care should also be taken to obtain bread that has been duly baked. Unless all its parts are intimately mixed, and the fixed air expelled, it will be apt, in very small quantities, to produce acescency and indigestion.

After stating the advantages of bread, it is necessary to make a few observations upon the evils which it may occasionally produce. In certain diseases it evidently produces a tendency to acidity; we have daily instances of this fact in children, in whom acidity and much alimentary disturbance follow its use. Shebbeare goes so far as to say that the rickets are so common in France only because the quantity of bread given to children is excessive; which, by its acidity, destroys the calcareous substance of the bones, and reduces them to a state of cartilage. This is mere idle speculation, which is in direct variance with the received opinions upon this subject. Where acidity occurs, the bread should be toasted, or well-prepared biscuit substituted.

Much has been said and written upon the subject of the adulteration of bread; but we are inclined to believe that the evils arising from such a practice have been greatly exaggerated. It is certain that the inferior kinds of flour will not make bread of sufficient whiteness to please the eye of the fastidious citizen without the addition of a proportion of alum. It has been also found that unless this salt be introduced into the flour, the loaves stick together in the oven, and will not afterwards separate from each other with that smooth surface which distinguishes the loaf of the baker. This circumstance is probably owing to the action of the alum upon the mucilage of the flour, which it coagulates. It has been said that the smallest quantity that can be employed for these purposes is from three to four ounces to two hundred and forty pounds of flour. It cannot be denied that the introduction of a portion of alum into the human stomach, however small, may be prejudicial to the exercise of its functions, and particularly in dyspeptic invalids. It was found by Mr. E. Davy, of Cork, that bad flour may be made into tolerable bread by adding to each pound from twenty to forty grains of the common carbonate of magnesia.

Besides bread, several other preparations are made by the solidification of flour, such as pudding, pancake, &c. The most digestible pudding is that made with bread or biscuit and boiled flour: *batter* pudding is not so easily digested; and *suet* pudding is to be considered as the most mischievous to invalids in the whole catalogue. *Pancake* is objectionable on account of the process of frying imparting a greasiness to which the dyspeptic stomach is not often reconciled. All *pastry* is also objectionable: we believe that one half at least of the cases of indigestion which occur after dinner-parties may be traced to this cause.

Many persons entertain a strange prejudice in favour of *pudding*, and appear as if they considered it to possess a balsamic virtue, or some property by which the digestion of other aliment is expedited. If ever such a diet has served the valetudinarian, it must have been by excluding less stimulating food, and not by any virtue adherent in the *pudding* itself.

Amongst the farinaceous aliments, the *potato* holds a distinguished rank; but its digestibility greatly depends upon its kind, and the nature of the cookery to which it is subjected. The species which is known by the name of *waxy* potato should be shunned by the dyspeptic, for it is so indigestible as to pass through the intestines in an unaltered state. The same objection applies to the young or new potato. The mealy kind more readily yields to the powers of the stomach, and affords a healthy nutriment: but to the dyspeptic, we have generally found this vegetable, in all its states, to be injurious; if ever allowed to such patients, it is worthy of remark that *roasting* is preferable to every other form of cookery. The process of *mashing* certainly does not contribute to its digestibility. If boiled, care should be taken that it is not over-done; for in such a case it is deprived of its nutritious qualities.

Rice is the general aliment of the people of the East, with whom it answers the same purposes as bread does with us. As it is not much disposed either to acescency or fermentation in the stomach, it furnishes a wholesome aliment when mixed with other food; but if taken in large quantities by itself, from its low degree of stimulant properties, it is apt to remain for a length of time in the stomach: this effect is greatly increased by protracted boiling. Where the stomach is in a state of relaxation and debility, it ought not to be taken without condiment; it is, for this reason, found necessary in the warmer climates to conjoin it with a considerable quantity of warm spices. There formerly existed a prejudice against its use, from a belief that it had a tendency to produce blindness. It is scarcely necessary to state that such an idea has no foundation in truth. It is generally considered as astringent, and is, therefore, a popular remedy for diarrhœa; no astringent principle, however, has yet been discovered in its composition, and it is probable that it owes its virtues on such occasions to the mild and bland mucilage, with which it abounds, shielding the intestines from acrimonious humours.

There are various other aliments in domestic use which owe their qualities to starch, such as *sago, tapioca, arrow-root, &c.* From the mucilaginous form in which they are usually administered to invalids, they are not so digestible as is generally supposed; but where the stomach rejects more substantial food, they are useful in themselves, as well as proper vehicles for the administration of vinous stimulants.

The leguminous productions, or *pulses*, may be considered as constituting the second division of farinaceous aliment. They differ little from grains, except in affording a more unctuous flour, which forms a milky solution with water, owing to the presence of an oily matter. Although they are highly nutritive, they are certainly more indigestible than seeds, and the bread they afford is apt to occasion flatulence, and to lie heavy on the stomach. The use, therefore, of this species of food is more circumscribed than that of the farinaceous seeds; it is principally confined to the lower classes, and to those possessing strong powers of digestion. In dyspeptic habits they ought on no account to be allowed; the symptoms of uneasiness which they produce in such persons are often alarming: flatulence and colic are the common consequences of their action. Pulses are employed in two very different states; in an early stage of their growth, when they are succulent; and when all their parts have reached maturity: in the former condition they are frequently acceptable to the stomach; but in the latter they are only calculated for those who have strong digestive powers.

Peas form a wholesome and light food when green and young, but when full grown and dry they are very indigestible: in this latter state they contribute, in a remarkable degree, to the generation of gas in the intestines. In the form of pudding they are, if possible, still more objectionable; for, to the bad qualities which depend upon their composition, are thus added those which arise from tenacity of texture. *Beans*, like peas, are comparatively wholesome in their immature state. The *kidney-bean*, being eaten with its pod, is not so flatulent as other pulse: when well boiled, it is easy of digestion, but not very nutritive.

Nuts are generally supposed to have constituted the earliest food of mankind; and they still furnish, in some countries, a considerable source of food. In this country they are principally known as an article of the dessert, although on some occasions they are eaten with our food. With regard to composition, the chestnut may perhaps be considered as more nearly allied to the pulse than to the nut tribe, since it affords no oil by expression, and from its farinaceous qualities it may even be made into bread, although it is heavy and indigestible. Its nutritive power must be considerable, since it forms the chief food of the lower orders of the plains in Lombardy; and it has been conjectured that it was the *acorn* so frequently mentioned in ancient history and tradition. When eaten after dinner, an indulgence which can only be conceded to the most robust, it ought to be previously roasted; its digestibility is also increased by being kept for some time after it has been gathered. It is at the same time thus rendered more palatable by the greater evolution of its saccharine principle.

The evils which may arise from the use of the chestnut are still more likely to occur after the ingestion of nuts, for they are more oily, as well as more viscid and glutinous: when eaten, they should always be accompanied with salt; but it would be wise to banish them entirely from our tables.

Esculent Roots.—These are of two kinds; those used as food, and those which principally answer the purposes of condiment or seasoning. Under the first division may be classed *turnips, carrots, parsnips, Jerusalem artichokes, radishes,* &c., many of which, it will be seen, are seldom used solely for aliment, but are rather brought to our tables to qualify our animal food. Under the second division may be arranged *onions, garlic, horse-radish,* &c. It will be necessary to offer a few observations upon the qualities of these several roots.

The *carrot*, from the quantity of saccharine matter which it contains, is very nutritive and slightly laxative; but it also possesses a large proportion of fibrous matter, which in some stomachs prevents the digestion of the root, and it passes through the bowels with but little change: to obviate this effect, it ought to be very thoroughly boiled, and it should be eaten when young. It appears to have been introduced by the Flemings, in the reign of Elizabeth. The *turnip* is a very excellent vegetable, and, although it has the character of being flatulent, it is less liable to disagree with the stomach than the carrot; it ought, however, to be well boiled, and the watery part separated by pressure. Lord Townshend, secretary to Charles I., was the person who introduced its use into England; but it appears that the ancient Romans, in the best period of their republic, lived much upon this root. The *parsnip* is nutritive and digestible, although many persons dislike it on account of its sweet flavour. The *Jerusalem artichoke* is agreeable, but watery and flatulent; it ought, therefore, never to be eaten without a proper accompaniment of salt and pepper. All the varieties of *radishes* have a pungent and acrid taste, in consequence of a peculiar stimulating matter, which resides in the cortical part of the root. They may be said to contain little else than water, woody fibre, and acrid matter, and cannot, therefore, be very nutritive; they may act as a stimulant, and thus prove useful, but they ought never to be eaten when old, as the quantity of inert matter in such a condition is apt to disagree with the stomach. From the consideration of radishes, we pass, by an easy transition, to that of onions, &c., for they appear to form the connecting link between alimentary roots and those used principally as condiment. The *onion*, however, although classed under this latter division, and must be considered as valuable on account of its stimulating matter, certainly contains a considerable proportion of nourishment. This appears evident in its boiled state, by which process its acrimony is exhaled, and a sweet mucilage separated. Sir John Sinclair says that it is a well-known fact that a Highlander, with a few raw onions in his pocket, and a crust of bread, or some oat-cake, can travel almost to an incredible extent, for two or three days together, without any other sort of food. The French are fully aware of the quantity of nourishment this plan affords; hence the soup *à l'oignon* is considered by them as the best of all restoratives. As a stimulant to the stomach and bowels, the onion, in a raw state, is certainly of value, and this is much enhanced by its diuretic qualities. The leek, garlick, shallot, are of the same species, and possess qualities of the same nature. *Horse-radish* is a warm and pungent root, and is highly valuable to the dyspeptic as a stimulant; it is, perhaps, the best of all condiments for the prevention of flatulence.

Esculent Herbs.—In this class are arranged the leaves and stalks of such vegetables as are eaten at table in the form of "greens and salads." Herbs eaten in a raw state are far less digestible than when cooked. During the heats of summer they are refreshing, and are well calculated to assuage that febrile state which full meals of animal food are known to occasion. Of all these herbs the *water-cress* is the most beneficial; for, by operating in some degree as an aromatic, it promotes digestion, and corrects that tendency to flatulency which other raw vegetables are apt to produce. According to Xenophon, the ancient Persians lived upon water-cresses, which they considered the most wholesome of vegetable productions. The *lettuce* is generally eaten with other herbs, in the form of a salad, dressed with oil and vinegar. Some difference of opinion has arisen with respect to the propriety of such additions. Gosse, of Geneva, found that vinegar retarded its solution in the stomach, and oil has been stated by others to render it less digestible. We have generally found such condiments useful, and that dressed lettuce is less likely to ferment in the stomach than that which is eaten without them. Oil is known to have such an effect in checking fermentation, and the vinegar is not found to promote it. The lettuce contains a narcotic* principle; and the effect of this is, in a great measure, obviated by a vegetable acid: those persons, therefore, who eat lettuce with a view to obtain such effects, ought to take it without vinegar. The digestibility of celery is greatly increased by maceration in vinegar. *Cucumbers* are by far the most unwholesome of all raw vegetables, and should be avoided as poison by dyspeptics.

The vegetables which require to be boiled are the different species and varieties of *colewort*; the value of which does not depend so much upon their nutritive quality as the tenderness of their texture. On this account, the cauliflower and brocoli are the species to be preferred, particularly the younger sprigs of the former. Of the kinds where the leaves only are employed, the Savoy is of a sweeter and more tender texture than the others, particularly its central and upper leaves. The cabbage tribe appear to contain a peculiar essential oil, whence the unpleasant odour of cabbage-water; this matter is liable to produce offensive effects on the stomach: the vegetable should therefore be boiled in two successive waters, in order to free it entirely from the noxious ingredient, and at the same time to render its texture soft and digestible. *Asparagus* is quickly dissolved in the stomach, and, when sufficiently boiled, is not disposed to create flatulence or acidity: along with its mucilage it frequently contains some sweetness, which affords a proof of its nutritive quality. From the peculiar odour which it imparts to the urine of those who eat it, it appears to possess some active matter distinct from its mucilage; and it is generally considered diuretic. Asparagus is only wholesome when in an intermediate state between root and plant. When older than this, it is remarkably acrid.

Fruits.—These are generally regarded as articles rather of luxury than of food; and were we to form our opinion of their value from their abuse, we should certainly be rather disposed to class them under the head of poisons than of aliments. Nothing can be more mischievous to the invalid than large quantities of apples, pears, and plums, in the form of dessert, after the stomach has been already loaded. But, when taken under other circumstances, they contribute to health, and appear to be providentially sent at a season when the body requires that cooling and antiseptic aliment which they are so well calculated to afford.

Fruits may be arranged under the following heads: stone fruits, the apple species, small-seeded fruits, small berries, and farinaceous fruits.

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* We are told that Galen, in the decline of life, suffered much from morbid vigilance, until he had recourse to eating a lettuce every evening, which cured him.

The stone fruits have been denounced as the least digestible species by popular acclamation, but much of the mischief that has been attributed to their use has arisen from the unripe state in which they were eaten. They are, however, certainly less digestible than other species, and more liable to undergo fermentation in the stomach. The hard pulp of certain plums remains also in the alimentary canal for a long time, and is frequently passed without having been materially changed. The ripe peach is the most delicious, as well as one of the most digestible of the stone fruits; the apricot is equally wholesome, but the nectarine is liable to disagree with some stomachs. Cherries are far less digestible; their pulpy texture and skins are not easily disposed of by the stomach; and as the sweetest species contain a considerable excess of acid, they may be objectionable in some cases, and desirable in others. The apple species are not so dilute and watery as the foregoing fruits, and is less apt to pass into a state of noxious fermentation; but its texture is firmer, and on that account it is retained longer in the stomach, and often proves indigestible. The same observations apply to pears, except that, their texture being in general less firm, they are less objectionable. The orange, when perfectly ripe, may be allowed to the most fastidious dyspeptic; but the white, or inner skin should be scrupulously rejected, for it is not more digestible than leather. The small-seeded fruits are by far the most wholesome. Of these the ripe strawberry and raspberry deserve the first rank. The grape is also cooling and antiseptic, but the husks and seeds should be rejected. The gooseberry is less wholesome on account of the indigestibility of the skin, which is too frequently swallowed. The fruits to be classed under the head of small berries are the cranberry, the bilberry, and the red whortleberry. These are rarely eaten, except when baked, and in that state their acescency seldom proves injurious. The farinaceous fruits are universally unwholesome. The melon, which is the principal one, is very apt to disagree with weak stomachs, and should never be eaten after dinner, even by persons in health, without a plentiful supply of salt and pepper.

By cookery, fruit, otherwise unwholesome, may be converted into a safe and useful aliment. Apples, when baked, afford a pleasant repast, and from their laxative properties, are well adapted to certain forms of dyspepsia. Dried fruits, from the quantity of sugar which generally enters into their composition, are very much disposed to ferment and occasion heartburn.

[The following table exhibits the time required for the stomachal digestion of different alimentary substances, in a well-known case, which fell under the care of Dr. Beaumont, and which the writer had an opportunity of seeing. The table is copied from another work, (the writer's *Elements of Hygiène*, 2d edit. Philad. 1844.) The most digestible substances are taken as the standard, which has been arbitrarily fixed at 1000; and accordingly, as *aponeurosis*, the first article in the table, required three hours, whilst *pigs' feet soused, rice*, &c. required but one, its digestibility compared with that of these aliments, is as 333 to 1000; and so of the others. It need scarcely be said, that all such tabular results apply in strictness to the individual concerned only; yet they afford useful comparative views, which, with exceptions depending upon individual peculiarities, may be regarded as approximations applicable to mankind in general.

ALIMENTS.	Form of preparation.	Time requir'd for stomachal digestion.		Ratio of digestibility compared with the most digestible articles* in the table
		h.	m.	
Aponeurosis	boiled	3		333
Apples, mellow	raw	2		500
Do. sour, hard	do.	2	50	352
Do. sweet, mellow	do.	1	50	545
Barley	boiled	2		500
Bass, striped, fresh	broiled	3		333
Beans, pod	boiled	2	30	400
Do. and green corn	do.	3	45	266
Beef, fresh, lean, rare	roasted	3		333
Do. do. do. dry	do.	3	30	285
Do. do. steak	broiled	3		333
Do. with salt only	boiled	2	45	363
Do. with mustard, &c.	do.	3	30	285
Do.	fried	4		250
Do. old, hard salted	boiled	4	15	235
Beets	do.	3	45	266
Brains, animal	do.	1	45	571
Bread, corn	baked	3	15	302
Do. wheat, fresh	baked	3	30	285
Butter†	melted	3	30	285
Cabbage, head	raw	2	30	400
Do. with vinegar	do.	2		500
Do.	boiled	4	30	222
Cake, corn	baked	3		333
Do. sponge	do.	2	30	400
Carrot, orange	boiled	3	15	302
Cartilage	do.	4	15	235
Catfish, fresh	fried	3	30	285
Cheese, old, strong	raw	3	30	285
Chicken, full grown	fricasseed	2	45	363
Codfish, cured dry	boiled	2		500
Corn, (green) and beans	do.	3	45	266
Custard	baked	2	45	363
Duck, domesticated	roasted	4		250
Do. wild	do.	4	30	222
Dumpling, apple	boiled	3		333
Eggs, fresh	hard boiled	3	30	285
Do. do.	soft boiled	3		333
Do. do.	fried	3	30	285
Do. do.	roasted	2	15	444
Do. do.	raw	2		500
Do. do.	whipped	1	30	666
Flounder, fresh	fried	3	30	285
Fowls, domestic	boiled	4		250
Do. do.	roasted	4		250
Gelatin	boiled	2	30	400
Goose, wild	roasted	2	30	400
Heart, animal	fried	4		250
Lamb, fresh	boiled	2	30	400

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* [Pigs' feet soused, rice, and tripe soused, being the most digestible articles in the table, are estimated at 1000.]

† [In the case of oils, and other substances of similar nature, which undergo little digestion in the stomach, the time merely indicates the period that elapses before they are sent into the duodenum.]

ALIMENTS.	Form of preparation.	Time requir'd for stomachal digestion.		Ratio of digestibility compared with the most digestible articles in the table
		h.	m.	
Liver, beef's, fresh	boiled	2		500
Marrow, animal, spinal	do.	2	40	375
Meat and vegetables	hashed	2	30	400
Milk	boiled	2		500
Do.	raw	2	15	444
Mutton, fresh	roasted	3	15	307
Do. do.	broiled	3		333
Do. do.	boiled	3		333
Oysters, fresh	raw	2	55	342
Do. do.	roasted	3	15	307
Do. do.	stewed	3	30	285
Parsnips	boiled	2	30	400
Pig, sucking	roasted	2	30	400
Pigs' feet, soused	boiled	1		1000
Pork, fat and lean	roasted	5	15	190
Do. recently salted	boiled	4	30	222
Do. do.	fried	4	15	235
Do. do.	broiled	3	15	302
Do. do.	raw	3		333
Do. do.	stewed	3		333
Potatoes, Irish	boiled	3	30	285
Do. do.	roasted	2	30	400
Do. do.	baked	3	20	400
Rice	boiled	1		1000
Sago	do.	1	45	571
Salmon, salted	do.	4		250
Sausage, fresh	broiled	3	20	300
Soup, barley	boiled	1	30	666
Do. bean	do.	3		333
Do. beef, vegetables, & bread	do.	4		250
Do. chicken	do.	3		333
Do. marrow bones	do.	4	15	235
Do. mutton	do.	3	30	285
Do. oyster	do.	3	30	285
Suet, beef, fresh	do.	5	30	181
Do. mutton	do.	4	30	222
Tapioca	do.	2		500
Tendon, boiled	do.	5	30	181
Tripe, soused	boiled	1		1000
Trout, salmon, fresh	do.	1	30	666
Do. do.	fried	1	30	666
Turkey, domestic	roasted	2	30	400
Do. do.	boiled	2	25	511
Do. wild	roasted	2	18	435
Turnips, flat	boiled	3	30	285
Veal, fresh	broiled	4		250
Do. do.	fried	4	30	222
Vegetables and meat, hashed	warmed	2	30	400
Venison, steak	broiled	1	35	631]

Of Drinks, or Liquid Aliments.—As the introduction of solid aliment into the stomach is for the purpose of furnishing materials for the repair of the different textures, so is a supply of liquid matter essentially necessary to replace the fluids which are constantly ejected from the body, during the exercise of its numerous functions. In this point of view, therefore, the drinks ought to be considered as real aliments. The chyme and the chyle may also require the assistance of some liquid medium to increase the fluidity of the mass, or to favour the absorption of its finer and more nutritive parts. In every point of view, therefore, dilution is an essential operation; and an animal will not only endure the sensation of hunger with more tranquillity than that of thirst, but he will survive longer under the privation of solid than of liquid aliment.

Before we enter upon this part of the subject, it will be necessary that we should offer a few remarks upon the nature of the changes which liquids undergo when introduced into the stomach, and which would appear to be determined by the nature of their composition. The subject teems with curious facts, and is one of much importance to the physician, as it will enable him to appreciate the utility of liquid diet, and to understand the circumstances which should decide its preference.

It was long supposed that liquids, like solids, passed through the pylorus into the intestines, and were absorbed together with the chyle, or rejected with the excrement. It is not asserted that this never occurs; but it is evident beyond contradiction that there must exist another passage, although its nature remains obscure, by which liquids can be conveyed to the circulation; for it has been shown that, if a ligature be applied round the pyloric orifice, in such a manner as to obliterate the passage into the duodenum, the disappearance of the liquid from the cavity of the stomach is not so much even as retarded. In order to discover whether drinks are absorbed along with the chyle, M. Magendie made a dog swallow a certain quantity of diluted spirit during the digestion of his food; in half an hour afterwards the chyle was extracted and examined: it exhibited no trace of spirit, but the blood exhaled a strong odour of it, and by distillation yielded a sensible quantity.

If a liquid, holding nutritive matter in solution, be introduced into the stomach, it is either coagulated by the gastric juice, or its watery part is absorbed, and the solid matter deposited in the stomach; in either case the solid product is converted into chyme. Milk, as we formerly observed, appears to be the only liquid aliment which Nature has prepared for our nourishment; but it seems that she has, at the same time, provided an agent for rendering a certain portion of it solid; and hence we are led to infer that this form is an indispensable condition of bodies which are destined to undergo the processes of chymification and chylification; and that, unless some provision had existed for the removal of fluids from the stomach, the digestive functions could not have been properly performed. When the broth of meat is introduced into the stomach, the watery part is carried off, and the gelatine, albumen, and fat are then converted into chyme. Wine and fermented liquors undergo a similar change; the alcohol which they contain coagulates a portion of the gastric juice, and this residue, together with the extractive matter, gum, resin, and other principles which the liquid may contain, is then digested. Under certain circumstances these liquids may observe a different law of decomposition, which will, perhaps, in some measure explain the different effects which such potations will produce; for example, the spirit may undergo a partial change in the stomach, and be even digested with the solid matter, or, on some occasions, be converted into an acid by a fermentative process; this will be more likely to occur in vinous liquors, which contain ingredients favourable to the production of such a change, and hence the deleterious property of fermented liquors does not bear an unvarying relation to the absolute quantity of their alcohol. Oil, though possessing the fluid form, does not appear to observe the law which governs the disposal of such bodies; it is not absorbed, but is entirely transformed into chyme by the stomach. To effect this change, however, it seems essential that the stomach should be in a state of high energy, or the fluid will undergo chemical decomposition; nor will the stomach, unless it be educated, as it were, to this duty, like those of some northern nations, digest any considerable quantity of it; and since it cannot be absorbed, it must find its exit through the alimentary canal, and consequently prove laxative.

In classing the different species of drinks, we may, as with solids, arrange them according to their chemical composition, thus—

I. WATER.—Spring, river, well-water, &c.

II. THE JUICES AND INFUSIONS OF ANIMAL AND VEGETABLE SUBSTANCES.—Whey, tea, coffee, &c.

III. FERMENTED LIQUORS.—Wine, beer, &c.

IV. THE ALCOHOLIC LIQUORS, OR SPIRITS.—Alcohol, brandy, rum, &c.

Water.—The qualities of water differ essentially according to the source from which it has been obtained; and those accustomed to this beverage are sensible to differences which wholly escape the observation of less experienced judges. How far the existence of foreign matter injures its salubrity has been a subject of much controversy. That the presence of very minute quantities of earthy matter can become a source of disease sounds strangely to the ears of the philosopher; and yet we have known patients, after drinking a glass of water, from a sense of weight and oppression at the stomach, at once pronounce the existence of foreign ingredients. Animals would appear to be generally more sensible of such impurities than man. Horses, by an instinctive sagacity, always prefer *soft*[*] water; and when, by necessity or inattention, they are confined to the use of that which is *hard*, their coats become rough and ill-conditioned, and they are frequently attacked with gripes. Pigeons are also known to refuse hard, after they have been accustomed to soft water. We are informed by Cleghorn that on the eastern side of the island of Minorca, the sheep, on account of the hardness of the water, are subject to a disease in the spleen. But the most dangerous sources of impurity exist in the animal and vegetable kingdoms; putrescent matter poisons our beverage, and becomes the secret cause of numerous complaints. The usual varieties of common water were classed and defined by Celsus, and modern chemists have not found any reason to reject the arrangement. "*Aqua levissima pluvialis est; dein fontana, tum ex flumine, tum ex puteo; post hæc ex nive aut glacie, gravior his ex lacû, gravissima ex palude.*"

We may remark of river water, that, as it is derived from the conflux of numerous springs and rain water, the proportion of its saline constituents ought to be small, since various precipitations must necessarily take place from the union of different solutions. It is, however, liable to hold in suspension particles of earthy matter which impair its transparency, and not unfrequently its salubrity. It may also, in the vicinity of a large town, hold dissolved, as well as suspended, a considerable portion of animal and vegetable matter: this is unquestionably the case in the water supplied from the Thames by the Grand Junction Water-Company.

For the purification and preservation of water, numerous ingenious methods have been adopted. The mechanical impurities may be easily enough removed by filtration, a process which is suggested by Nature herself, for all springs arising through sand, gravel, &c. must undergo such an operation; but it will not remove a particle of that matter which is held in solution, and hence the filter is only of partial utility. As that peculiar property which constitutes what is termed *hardness* generally depends upon *sulphate of lime* in solution, it cannot be removed by filtration, but the addition of an alkaline carbonate, in the proportion of from ten to fifteen grains, to every pint, twenty-four hours before it is used, will be found to soften it; or, if it should be found to depend upon *supercarbonate of lime*, which is sometimes the case, long ebullition, without any addition, will be found sufficient for its cure. Another mode of improving water, and one which has been lately adopted by Mr. Robins in his patent filters, is by the application of charcoal, a substance which possesses in an eminent degree the property of preserving water from corruption, and of purifying it after it has been corrupted; hence the filtration of water through alternate layers of sand and charcoal offers the readiest and most effectual mode of abstracting its impurities with which we are acquainted.[†] Where we have reason, however, to suspect much injurious contamination, the process of boiling should never be omitted; after which it may be strained and filtered, and lastly agitated in contact with the atmosphere, in order to restore to it its natural proportion of air. In China, water is never drunk until it has been boiled. The mischievous effects of impure water, where it cannot be corrected by any chemical process, are said to be best counteracted by some bitter vegetable. Virey supposes that this circumstance first induced the Chinese to infuse the leaves of the tea-plant.

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[*] An important practical distinction has been founded upon the fact, that the water of some springs will dissolve soap, while that of others decomposes and curdles it; the former has been denominated *soft*, the latter *hard* water. Sulphate of lime is generally the salt which imparts this quality of hardness; and it appears that the proportion of five grains to the pint is sufficient for the purpose. Soft water is a more powerful solvent of all vegetable matters, and is consequently to be preferred for domestic as well as medicinal use. The brewer knows well, from experience, how much more readily and copiously *soft* water will dissolve the extractive matter of his malt; and the housewife requires not the chemist to inform her that *hard* water is incapable of making good tea.

[†] The great desideratum has ever been to remove *soluble* matters from water; it is by no means impossible that a simple voltaic apparatus will hereafter be contrived for such a purpose.

Water is unquestionably the natural beverage of man; but any objection against the use of other fluids founded on their artificial origin, may be at once met by the same argument which has been adduced in defence of cookery. We are to consider man as he is, not as he might have been had he never forsaken the rude path of nature. We are ready to admit that the more simply life is supported, and the less stimulants we use, the better; and that he is happy who considers water the best drink, and salt the best sauce; but how rarely does a physician find that his patient has regulated his life by such a maxim! He is generally called upon to reform stomachs already vitiated by bad habits, and which cannot, without much discipline, be reconciled to simple and wholesome aliment. Under such circumstances, nothing can be more injudicious than abruptly to withdraw the accustomed stimulants, unless it can be clearly shown that they are absolutely injurious,—a question which it will be our duty to investigate.

The juices and infusions of vegetable and animal matter constitute the second division of drinks.

Toast-Water.—By impregnating water with the soluble parts of toasted bread, we shall obtain a liquid which will frequently agree with those stomachs which rebel against the use of the mere simple fluid. It is thus also rendered slightly nutritive, holding a certain portion of gum and starch in solution. Sir A. Carlisle recommends that it should be prepared with hard biscuit, reduced by fire to a coffee colour. "This drink," says he, "being free from yeast, is a most agreeable beverage. Much depends upon the water, employed for its preparation, being at a boiling temperature, and it ought to be drunk as soon as it has sufficiently cooled; for, by being kept, it acquires a mawkish and unpleasant flavour. Infusions of other kinds of bread, especially those of toasted oat-cakes, and dried or toasted oatmeal, have been recommended; but the taste of such infusions would not be palatable to any one who has not been accustomed to oat-bread.

Barley-Water.—The decoction of barley is a very ancient beverage; it is recommended by Hippocrates, and preferred by him to every other aliment in acute diseases. Barley has the advantage over other grains, in affording less viscid potations. The invention of *pearl barley* has greatly increased the value of this grain; it is prepared by the removal of its husk or cuticle, and afterwards by being rounded and polished in a mill. These well-known granules consist chiefly of fecula, with portions of mucilage, gluten, and sugar, which water extracts by decoction; but the solution soon passes into the acetous fermentation. The bran of barley contains an acrid resin, and it is to get rid of such an ingredient that it is deprived of its cuticle. The addition of lemon-juice and sugar-candy greatly improves the flavour of this drink.

Gruel.—Oats, when freed from their cuticle, are called *groats;* in which state, as well as when ground into meal, they yield to water, by coction, the fecula they contain, and form a nutritious gruel, which has also the property of being slightly aperient. It should never be kept longer than forty-eight hours, as it becomes acescent after that period. Gruel may be made of a different degree of consistence, according to the object of its potation. If it be used as a demulcent drink, it should be thin; and may be made, as Dr. Kitchener, our culinary censor, informs us, by mixing well together, by degrees, in a pint basin, *one* table-spoonful of oatmeal with three of cold water, and then adding carefully a pint of boiling water, which is to be boiled for five minutes, stirring it all the time, to prevent the oatmeal from burning at the bottom of the stewpan; then strain through a hair sieve, to separate the undissolved parts of the meal from the gruel. If a more substantial repast is required, double the above quantity of oatmeal must be treated in a similar manner. To increase the nutritive quality of this aliment, broth or milk may be substituted for water. Some persons are in the habit of introducing a piece of butter into gruel; but the propriety of this practice is questionable, where the stomach is supposed to generate acidity.

Sage Tea.—The virtues of sage have been so extravagantly praised, that, like many of our remedies, the plant is fallen into disuse from the disgust which its panegyrists have excited. We are convinced, however, that in the form of infusion it possesses some power in allaying the irritability of the stomach, (it is frequently used by the Chinese as a tonic for debility of the stomach,) and that, on many occasions, it will furnish a salutary beverage. The same observation will apply to the infusions of *balm* and *rosemary*. A drink extremely agreeable to the stomach of invalids may also be made by infusing lemon-peel in boiling water, and adding a small quantity of sugar.

Tea.—There is no subject that has occasioned a greater controversy amongst dietetic writers than that of tea. By one party it is decried as a poison; by another it is extolled as a medicine, and a valuable addition to our food; while some refer all its beneficial effects to the water thus introduced into the system, and its evil consequences to the high temperature at which it is drunk. In order to understand the value of the different arguments which have been adduced in support, or to the disparagement, of this beverage, it will be necessary to inquire into its composition. Two kinds of tea are imported into this country, distinguished by the epithets *black* and *green*. Both contain astringent and narcotic principles, but in very different proportions; the latter producing by far the most powerful influence upon the nervous system. As the primary operation of every narcotic stimulant, tea is found to exhilarate and refresh us, although there exist individuals who are so morbidly sensible to the action of certain bodies of this class, that feelings of depression, accompanied with various nervous sensations and an unnatural vigilance, follow the potation of a single cup of strong tea; while others experience, from the same cause, symptoms indicative of derangement of the digestive organs: but these are exceptions* from which no general rule ought to be deduced. The salubrity of the infusion to the general mass of the community is established by sufficient testimony to outweigh any argument founded on individual cases. It must, however, be admitted, that if this beverage be taken too soon after dinner, the digestion of the meal may be disturbed by the distension it will occasion, as well as by its influence as a diluent; the narcotic and astringent principles may also operate in arresting chymification; but when a physician gives it his sanction, it is with the understanding that it shall be taken in moderate quantities, and at appointed seasons. In enumerating the advantages of tea, it must not be forgotten that it has introduced and cherished a spirit of sobriety; and it must have been remarked by every physician of general practice, that those persons who dislike tea, frequently supply its place by spirit and water. The addition of milk certainly diminishes the astringency of tea; that of sugar may please the palate, but cannot modify the virtues of the infusion.

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* The reader is referred to a pamphlet entitled "*Observations on the Medicinal and Dietetic Properties of*

Coffee. — The hostility which has been manifested against the use of tea has been extended, with equal rancour, against that of coffee, and, probably, with equal injustice. The principle upon which its qualities depend is more stimulant than that of tea, and certainly exerts a different species of action upon the nervous system, although it is very difficult to define the nature of this difference. If taken immediately after a meal, it is not found to create that disturbance in its digestion which has been noticed as the occasional consequence of tea; on the contrary, it accelerates the operations of the stomach, and will frequently enable the dyspeptic to digest substances, such as fat and oily aliment, which would otherwise occasion much disturbance. The custom of taking coffee immediately after dinner, so universally practised by the French, no doubt must counteract the evil effects which the peculiar form of their diet is calculated to produce. Coffee, like tea, has certainly an antisoporific effect on many individuals; it imparts an activity to the mind which is incompatible with sleep; but this will rarely occur if the beverage be taken for several hours before our accustomed period of repose. It seems to be generally admitted that it possesses the power of counteracting the effects of narcotics; and hence it is used by the Turks with much advantage, in abating the influence of the inordinate quantities of opium they are accustomed to swallow. When our object is to administer it as a promoter of digestion, it should be carefully made by infusion; decoction dissipates its aroma. The addition of milk is one of questionable propriety; that of sugar, or rather sugar-candy, may be allowed. Some persons can never take this beverage without suffering from acidity in the stomach: where this happens, the practice must be abandoned.

[It appears from recent investigations of organic chemists, that *Theine*, the peculiar principle of tea, and *Caffeine*, the principle of coffee, are identical. "We shall never certainly," says Liebig, (*Animal Chemistry*, edit. cit. p. 169,) "be able to discover how men were led to the use of the hot infusion of the leaves of a certain shrub (tea), or of a decoction of certain roasted seeds (coffee). Some cause there must be, which would explain how the practice has become a necessary of life to whole nations. But it is surely still more remarkable, that the beneficial effects of both plants on the health must be ascribed to one and the same substance, the presence of which in two vegetables, belonging to different natural families, and the produce of different quarters of the globe, could hardly have presented itself to the boldest imagination. Yet recent researches have shown, in such a manner as to exclude all doubt, that caffeine, the peculiar principle of coffee, and theine, that of tea, are, in all respects, identical." And he adds (p. 170): "Without entering minutely into the medicinal action of caffeine (theine), it will surely appear a most striking fact, even if we were to deny its influence on the process of secretion, that this substance, with the addition of oxygen and the elements of water, can yield taurine, the nitrogenized compound peculiar to bile."]

Chocolate. — In consequence of the large quantity of nutritive matter which this liquid contains, it should be regarded rather as food than drink. It is prepared by reducing the cocoa-nut into paste, with sugar, milk, or eggs: it is also frequently mixed with different aromatics, the most common of which is the *vanilla*, a substance very liable to disagree with the stomach, and to produce a train of nervous symptoms. As a common beverage, chocolate is highly objectionable; it contains an oil which is difficult of assimilation; it therefore oppresses the stomach: this effect is of course increased by the application of too much heat in its preparation. Another objection against its use is to be found in the observations which we have already offered upon the subject of too great concentration.

Cocoa is usually considered as a substitute for chocolate. As it contains less nutritive matter, it is not so objectionable; and, as the oily matter exists only in small quantities, it is less likely to disagree with the stomach.

There are certain saline solutions which are frequently employed as drinks, and deserve some attention in this place: such are *imperial* and *soda water*. *Imperial* is a solution of cream of tartar flavoured with lemon-peel. It ought never to be used except as a medicine. If employed as an ordinary drink, it is apt to retard digestion. If ever useful as an article of diet, it will be under circumstances of robust health, and where a large quantity of animal food has been taken. The modern custom of drinking *soda water* during, or immediately after dinner, has been a pregnant source of dyspepsia. By inflating the stomach at such a period, we inevitably counteract those muscular contractions which are essential to chymification. The quantity of soda thus introduced scarcely deserves notice: with the exception of the *carbonic acid gas*, it may be regarded as water, more mischievous only in consequence of

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Green Tea," by W Newnham, Esq. There is a great deal of sound sense in this little production. The author refers the different effects produced by green tea to the different states of the system in which it is taken. He maintains that in a state of what he calls *sthenic excitement* of the brain and nervous system, as that produced by alcoholic stimulants, or by intense and long-continued application of the mind to any particular object of literary search, green tea will act as a salutary remedy; whereas, on the contrary, in states of diminished excitement, morbid vigilance and nervous disturbance will follow its potation.

the exhilarating quality inducing us to take it at a period at which we should not require the more simple fluid.

Fermented Liquors.—Volumes have been written to prove that spirit, in every form, is not only unnecessary to those who are in health, but that it has been the prolific source of the most painful and fatal diseases to which man is subject; in short, that Epimetheus himself did not, by opening the box of Pandora, commit a greater act of hostility against our nature than the discoverer of fermented liquors. This is a striking specimen of the fallacy of reasoning against the *use* of a custom from its *abuse*. There exists no evidence to prove that a temperate use of good wine, when taken at seasonable hours, has ever proved injurious to healthy adults. In youth, and still more in infancy, the stimulus which it imparts to the stomach is undoubtedly injurious; but there are exceptions even to this general rule. The occasional use of *diluted* wine has improved the health of a child, by imparting vigour to a torpid stomach: we ought, however, to consider it rather as a medicine than as a luxury.

Without entering further into the discussion of a question which has called so many opponents into the field, it may be observed that whatever opinion we may have formed as to the evils or advantages consequent upon the invention of wine, we are not called upon, as physicians, to defend it; our object is to direct remedies for the cure of those diseases which assail man as we find him in the habits of society. And as these habits, says Dr. W. Philip, are such that more or less alcohol is necessary to support the usual vigour of the greater number of people even in health, nothing could be more injudicious than wholly to deprive them of it when they are already weakened by disease, unless it could be shown that even a moderate use of it essentially adds to their disease, which, in dyspeptics, is by no means the case. Our own experience coincides with that opinion. In cases where the vinous stimulant has been withdrawn, we have generally witnessed an aggravation of the dyspeptic symptoms, accompanied with severe depression of spirits.

The term wine is more strictly and especially applied to express the fermented juice of the *grape;* although in common language it is used to denote that of *any* sub-acid fruit. The presence of *tartar* is perhaps the circumstance by which the grape is more strongly distinguished from all the other sub-acid fruits that have been applied to the art of wine-making. Its juice, besides, contains within itself all the principles essential to vinification, in such a proportion and state of balance as to enable it at once to undergo a regular and complete fermentation; whereas, the juices of other fruits require artificial additions for this purpose: and the scientific application and due adjustment of these means constitute the art of making domestic wines.* It has been remarked that all those wines which contain an excess of malic acid are of a bad quality: hence the grand defect that is necessarily inherent in the wines of this country, and which leads them to partake of the properties of cider; for in the place of the *tartaric*, the malic acid always predominates in our native fruits.

The characteristic ingredient of all wines is *alcohol;* and the quantity of this, and the condition or state of combination in which it exists, are the circumstances that include the more interesting points of inquiry, and explain the relative effects which different wines produce upon the system; we shall therefore proceed to investigate the various species, with reference to such conditions.

Wines may be at once resolved into two great divisions; into those which are coloured, and commonly called *red* wines, and into those which have a yellow tinge, more or less deep, termed *white* wines. This colouring matter is not derived from the juice, but from the husk of the grapes. If, therefore, the fermentation be not permitted to take place in contact with the hulls, and sometimes even with the stalks of the fruit, a *white* wine is in all cases produced. This colouring matter is highly astringent, and consequently the red wines differ from the white in their effects upon the stomach; and yet it is difficult to explain the well-known extent of this operation by the presence of so small a proportion of active matter. It must, however, be remembered that irritable stomachs are frequently impatient of astringent matter. Many persons are incapable of drinking port wine in consequence of the heartburn it occasions; while others, on the contrary, appear to derive advantage from the tonic influence of its astringency. This is a circumstance of idiosyncrasy which no theory can explain. Every physician must be practically aware of the caprice which the stomach displays in its morbid conditions; but as a general rule, it may be stated that *white* deserve a preference over *red* wines, because the latter, being pressed, and subjected to a stronger fermentation to extract the colouring principle from the husk, are necessarily more loaded with extractive and astringent matter; and as this remains in the stomach after the liquid portion of the wine is absorbed, it will be liable to occasion disturbance.

The odour, or *bouquet*, and flavour which distinguish one wine from another, evidently depend upon some volatile and fugacious principle not hitherto investigated by the chemist: this, in sweet and half-fermented wines, is immediately derived from the fruit, as in those from the *Frontignan* and *Muscat* grapes; but in the more perfect wines, as in *Claret*, *Hermitage*, *Rivesaltes*, and *Burgundy*, it bears no resemblance to the natural flavour of the fruit, but is altogether the product of the vinous process. Some wines are artificially flavoured by the introduction of foreign ingredients, as by almonds in Madeira wines, as well as in those of Xeres and St. Lucar; and hence their well-known nutty flavour. Among the ancients, and in modern Greece, it is at this day the fashion to give a resinous flavour, by the introduction of turpentine into the casks. These wines were supposed to assist digestion, to restrain morbid discharges, to promote urine, and to strengthen the bowels; but Dioscorides informs us that they were known to produce vertigo, pain in the head, and many evils not incidental to the potations of the same vinous liquor when free from such admixtures.

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* For an account of which, the reader is referred to a most ingenious and interesting essay by Dr. Macculloch, entitled "Remarks on the Art of making Wine; with Suggestions for the Application of its Principles to the Improvement of Domestic Wines."

The quantity of acid contained in wines has been supposed capable of diminishing their salubrity, and in some cases of rendering them eminently noxious. There can be no doubt that where there exists a considerable excess of gallic or malic acids, or where acetic acid has been generated during a protracted fermentation, such wine will be obnoxious to the stomach; but where the acid arises from the nature of the fruit, it surely cannot merit the odium which popular opinion would assign to it. What, for instance, is the acid contained in Madeira, and against which so many objections have been urged? an atom merely of tartar! And yet the person who fancies that his digestion can be deranged by its action, will swallow twenty times the quantity of the same ingredient in some other shape with perfect indifference and impunity.

Before we quit the subject of vinous acidity, we must add a few words upon its supposed influence in exciting paroxysms of gout. That such attacks have followed particular potations we do not mean to deny; but a slight excess of any kind, whether in diet or in exercise, will excite the disease in those predisposed to it. Where this predisposition exists, an additional glass of claret may excite the disease; but in all such cases any other exciting cause would have a similar effect.

It has been already stated that the characteristic ingredient of all wines is *alcohol;* and that its quantity, and the condition or state of combination in which it exists, are the circumstances in which the medical inquirer is principally interested. The late experiments of Mr. Brande have thrown considerable light upon this subject; although, as in most instances of discovery, they have raised up new doubts and difficulties. Daily experience convinces us that the same quantity of alcohol applied to the stomach under the form of wine, and in a state of mixture with water, will produce very different effects upon the body, and to an extent which it is difficult to understand. It has, for instance, been demonstrated beyond the reach of doubt, that port, madeira, and sherry contain from one-fourth to one-fifth of their bulk of alcohol; so that a person who takes a bottle of any one of them will thus take nearly half a pint of alcohol, or almost a pint of pure brandy! And, moreover, that different wines, although containing the same absolute proportion of spirit, will be found to vary very considerably in their intoxicating powers. No wonder, then, that such results should have staggered the philosopher, who is naturally unwilling to accept any tests of difference from the nervous system, which elude the ordinary resources of analytical chemistry. The conclusion was therefore drawn, that alcohol must necessarily exist in wine in a far different condition from that in which we know it in a separate state; or, in other words, that its elements only could exist in the vinous liquor, and that their union was determined, and, consequently, alcohol produced, by the act of distillation. That it was the *product*, and not the *educt* of distillation, was an opinion which originated with Rouelle, who asserted that alcohol was not completely formed until the temperature was raised to the point of distillation. More lately, the same doctrine was revived and promulgated by Fabbroni, in the Memoirs of the Florentine Academy. Gay Lussac has, however, silenced the partisans of this theory, by separating the alcohol by distillation, at the temperature of 66° Fahrenheit; and, by the aid of a vacuum, it has since been effected at 56°. And to complete the demonstration, Mr. Brande has shown that, by precipitating the colouring matter, and some other elements of the wine, by the *sub-acetate of lead*, and then saturating the clear liquor with *sub-carbonate of potass*, the alcohol may be separated without any elevation of temperature; and he has accordingly, by this ingenious expedient, been enabled to construct a table, exhibiting the proportions of spirit which exist in the several kinds of wine. No doubt, therefore, can any longer be entertained upon the subject; and the fact of the difference of effect produced by the same bulk of alcohol, when presented to the stomach in different states, is to be explained on the supposition that, in wine, it is not only more intimately mixed with water, but that it exists in combination with its extractive matter; in consequence of which it is incapable of exerting its full effects before it becomes altered in its properties, or, in other words, partially *digested;* and this view of the subject may be fairly urged in explanation of the fact, that the intoxicating effects of the same wine are liable to vary in degree in the same individual, from the peculiar state of his digestive organs at the time of its potation.

We have hitherto only considered alcohol as it exists in a combined state in wine; but it is essential to state that the stronger wines of Spain, Portugal, and Sicily, are rendered marketable in this country by the addition of *brandy*, and must consequently contain more or less *uncombined* spirit; but the proportion of which will not bear a ratio to the quantity added, because, at the period of its admixture, a renewed fermentation is produced by the scientific vintner, which will assimilate and combine a certain portion of the foreign spirit with thè wine: this manipulation, in technical language, is called "*fretting in*." It is to the quantity of *free*, not to that of *combined* spirit, that the injurious effects of such wines are to be attributed. "It is well known," observes Dr. Macculloch, "that diseases of the liver are the most common and the most formidable of those produced by the use of *ardent* spirits." It is equally certain that no such disorders follow the intemperate use of *pure* wine, however long indulged in: to the concealed and unwitting consumption of spirit, therefore, as contained in the wines generally drunk in this country, is to be attributed the excessive prevalence of those hepatic affections, which are comparatively little known to our continental neighbours.

Much has been said about the effects of *new* wine upon the stomach, compared with those produced by that which has been long kept. It will be necessary to consider the changes produced in this liquor by being kept. In the first place, red wine gradually deposits a quantity of cream of tartar, in combination with extractive and colouring matter, forming what is commonly called the crust; so that a considerable portion of that matter which is likely to disagree with the stomach is thus removed; but when kept in a cask, in addition to this change, a quantity of water is evaporated, and the wine becomes comparatively stronger. The custom of exposing Madeira to motion, and a certain elevation of temperature, by sending it a voyage to the East Indies, unquestionably improves the flavour, and produces some internal change in the composition of the wine, which the chemist is unable to explain.

In a dietetic point of view, wines may be arranged into four classes; viz. 1, *sweet wines*; 2. *sparkling* or *effervescing*; 3. *dry* and *light*; 4. *dry* and *strong*.

1. *Sweet wines* contain the greatest proportion of extractive and saccharine matter, and generally the least ardent spirit, though it is often rather disguised than absent. Since a proportion of sugar has remained unchanged in these wines during the process of vinification, they must be considered as the results of an imperfect fermentation, and are, in fact, mixtures of wine and sugar; accordingly, whatever arrests the progress of fermentation must have a tendency to produce a sweet wine. Thus, boiling the *must*, or drying the fruit, will, by partially separating the natural leaven, and dissipating the water, occasion such a result as is exemplified by the manufacture of the wines of Cyprus, the *Vino Cotto* of the Italians, and the *Vinum Coctum* of the ancients; by that of *Frontignac*, the rich and luscious wines of *Canary*, the celebrated *Tokay*, *Vino Tinto* (Tent of Hungary), the Italian *Monteflascone*, the Persian *Schiraz*, the *Malmsey* wines of Candia, Chio, Lesbos, and Tenedos, and those of the other islands of the Archipelago. On account of the sugar contained in such wines, they are liable to become acescent on weak stomachs; but where this is not the case, they are, in small quantities, frequently beneficial to invalids.

2. *Sparkling or effervescing wines.*—These are indebted for their characteristic properties to the presence of carbonic acid; they rapidly intoxicate, in consequence of the alcohol which is suspended in, or more probably, in chemical combination with the gas, being thus applied in a sudden and very divided state to a large extent of nervous surface: for the same reason their effects are generally as transitory as they are sudden. Independently of the alcohol thus held in solution in the carbonic acid, it is probable that some active aromatic matter is volatilised together with it, and which may account for the peculiar effects produced on some persons by champagne.

3. *Dry and light wines.*—These are exemplified by the more esteemed German wines, as hock, rhenish, mayne, moselle, neckar, and elsass; and those highly-flavoured wines, burgundy, claret, hermitage, &c. The former of these wines combine the effect of an acid with that of the spirit. They do not contain any uncombined alcohol, and on that account are to be greatly preferred. *Genuine* claret must be considered as the most beneficial of all our vinous liquors; it is well fermented; and on account of the small proportion of spirit, as well as of extractive, which it contains, it is more salubrious than port. It has been already observed that burgundy appears to hold dissolved some unknown principle of great activity; upon no other supposition can we explain its stimulant properties. A few glasses of this wine will produce heat and headach, which the relative quantity of alcohol in its composition will not account for.

4. *Dry and strong wines*, as madeira, port, sherry, &c. The name *sec*, corruptly written sack, signifies dry. The sec wine, prepared at Xeres, in Spain, is called, according to our orthography, sherris or sherry. In the manufacture of this wine, *lime* is added to the grapes; a circumstance, observes Dr. Macculloch, apparently conducive to its well-known dry quality, and which, probably, acts by neutralizing a portion of *malic* or *tartaric* acid.

It is a fact not easily explained, that the stomach is frequently outraged by a wine to which it has not been accustomed; and it is equally true that a mixture of different wines is a common source of indigestion. The custom of mixing wine with water has its advantages as well as its evils. By dilution it frequently proves too little stimulant to the stomach, and runs into a state of acescency. An invalid is also thus liable to deceive himself, by taking more wine than may be consistent with his welfare. Much, however, depends upon the quality of the wine taken; the lighter wines cannot require dilution, while port is certainly rendered less injurious by the admixture.

Home-made or domestic wines may be generally considered as injurious to delicate stomachs; they are apt to ferment and produce indigestion. Cider and perry are grateful drinks in hot weather; but as they do not contain a sufficient quantity of spirit to prevent their passing into the acetous fermentation in the stomach of an invalid, they should be avoided by those who have any predisposition to indigestion.

Beer.—This is an article of beverage in almost every country. The Chinese prepare it from rice, and the Americans from maize. We are also informed by Herodotus, that, in very early history, the art of making a fermented liquor from barley was discovered by the Egyptians. As the climate of England is not congenial to the growth of the vine, this species of liquor is perhaps more universal than in any other country; and it has therefore been denominated *vinum Britannicum*. In the higher walks of society, it has, indeed, of late years, been nearly excluded: but whether this revolution has been attended with advantage, we shall presently have occasion to inquire. Malt liquors differ from wines in several essential points: they contain a much larger proportion of nutritive matter, and a less proportion of spirit; while they contain a peculiar bitter and narcotic principle derived from the hop. It would appear that the extractive matter furnished by the malt is highly nutritive; and we accordingly find that persons addicted to such potations are in general fat. Where, however, they are indulged in to any extent, without a corresponding degree of exercise, they induce a plethoric state of the body, and all the diseases consequent upon such a condition. In order to understand the process by which they furnish nourishment, we must once more refer the reader to the observations which are offered on the important subject of the digestion of liquids; from which it will appear that highly-concentrated extract will be left in the stomach after the removal of its watery part. This extract is, for reasons already stated, not very digestible; and will therefore require the presence of less inspissated food to promote its chymification. Ale, therefore, when taken without such precautions, is liable to disturb the digestive organs. The addition of the hop increases the value of the liquor, by the grateful stimulus which it imparts, and in some measure redeems it from those vices with which it might otherwise be charged. To those therefore whose diet is not very nutritive, ale may be considered not only as an innocent but as a salubrious article; and happy is that country whose labouring classes prefer such a beverage to the mischievous potations of ardent spirit. These remarks cannot, however, apply to the classes of the community who "fare sumptuously every day." They will not require a nutritive potation of such a character; and light wines have accordingly, in these days of luxury, very properly superseded its use: but we are not disposed to extend this remark to its more humble companion, "*table beer.*" We regard its dismissal from the tables of the great as a matter of regret; its slight but invigorating bitter is much better adapted to promote digestion than its more costly substitutes. But it should be soft and mild; for when stale and hard it is likely to disturb the bowels, and occasion effects the very opposite to those it is intended to produce. Nor ought it to have too great a proportion of hops, but should be thoroughly fermented and purified. Sydenham always took a glass of small beer at his meals, and he considered it as a preservative against gravel.

The great division of malt liquors is into small beer, ale, and porter.

The liquor called *Ale* was originally made of barley, malt, and yeast alone. There existed for a long time a strong prejudice against hops, which were considered as "pernicious weeds;" but it is now generally admitted that they constitute the most valuable ingredient in malt liquors. Independently of the flavour and tonic virtues which they communicate, they precipitate, by means of their astringent principle, the vegetable mucilage, and thus remove from the beer the active principle of its fermentation: without hops, therefore, we must either drink our malt liquors new and ropy, or old and sour. There are several varieties of ale, distinguishable by their colour: when the malt is slenderly dried, the ale is *pale*; or *brown* when the malt is more roasted or high dried.

Porter.—This is made from high-dried malt, and differs from other malt liquors in the proportions of its ingredients, and by the peculiar manner in which it is manufactured. Much has been said upon the fraudulent adulteration of this article; but we are inclined to believe that these statements have been exaggerated.

Ardent Spirits.—The art of extracting alcoholic liquors by distillation from vinous liquors, must be regarded as the greatest curse ever inflicted upon human nature. The fatal effects of dram-drinking have been vividly depicted by numerous writers; and the awful truth has been too frequently illustrated to render any remarks in this place necessary. In a medical point of view, however, spirit may be considered as occasionally useful. Where it is taken in a diluted state, the mixture should always be made twelve hours before it is used. Spirit and water do not easily combine; and much of the force of the former is blunted by intimate incorporation with the latter, as we have already observed under the history of wine. We throw out this hint to those who are in the habit of drinking weak brandy and water at their meals: although the propriety of such a practice is questionable. There are cases of dyspepsia in which wine and beer equally disagree with the stomach, producing acidity and other distressing symptoms: very weak spirit may, perhaps, in such cases, be taken with advantage; but its strength should be uniform, and no circumstances should induce the patient to increase the proportion of the spirit. The habit of drinking *liqueurs* cannot be too much reprobated: many of these *cordials* are impregnated with narcotic substances, which add to the noxious qualities of the spirit.

OF CONDIMENTS.—These may be defined substances which are, in themselves, incapable of nourishing the body, but which, in concert with our food, heighten its flavour, promote its digestion, or correct some of its deleterious properties. The existence and necessity of such agents are more general and important than is generally supposed, and a philosophical examination of their *modus operandi* would disclose views of great and novel interest to the physician. The bitter principle which exists in the composition of grasses and of other plants, appears to be essential to the digestive process of herbivorous animals, for when deprived of it they become diseased; and yet we are assured, by repeated experiment, that it passes through the alimentary canal without undergoing the least change; it can therefore only act as a stimulant *in transitu*, and affords an excellent example of a natural condiment. We are ourselves conscious of the invigorating effects of slight bitters upon our stomach, although civilization has, to a great degree, destroyed our natural taste for them, while, by improving our vegetable food, it has probably rendered such a stimulus unnecessary. The Swiss peasant cheers himself amid the frigid solitude of his glaciers with a spirit distilled from *gentian*, the extreme bitterness of which is relished with a glee that is quite unintelligible to those who are not accustomed to it.

From the different nature of condiment, it has been usually divided into three classes, viz. the **saline**, the **spicy** or **aromatic**, and the **oily**.

Salt appears to be a necessary and universal stimulus to animated beings; and its effects upon the vegetable as well as animal kingdom have furnished objects of the most interesting inquiry to the physiologist, the chemist, the physician, and the agriculturist. It appears to be a natural stimulant to the digestive organs of all warm-blooded animals, and they are instinctively led to immense distances in pursuit of it. This is strikingly exemplified in the avidity with which animals in a wild state seek the salt-pans of Africa and America, and in the difficulties they will encounter to reach them: this cannot arise from accident or caprice, but from a powerful instinct, which, beyond control, compels them to seek at all risks that which is salubrious. We are all sensible of the effect of salt on the human body; we know how unpalatable fresh meat and most vegetables are without it. One of the ill effects produced by an unsalted diet is the generation of worms. In Ireland, where from the bad quality of the food the lower classes are greatly infested with worms, a draught of salt and water is a popular and efficacious anthelmintic. Lord Somerville, in his Address to the Board of Agriculture, gave an interesting account of the effects of a punishment which formerly existed in Holland. "The ancient laws of the country ordained men to be kept on bread alone, *unmixed with salt*, as the severest punishment that could be inflicted upon them in their moist climate. The effect was horrible; these wretched criminals are said to have been devoured by worms engendered in their own stomachs." The wholesomeness and digestibility of our bread are undoubtedly much promoted by the addition of the salt which it so universally receives.*

If the utility of salt be thus established, it may be asked how it can happen that salted provisions should ever produce those diseases which experience has shown to arise from their use. In explaining the operation of *salting* meat, and in appreciating the effects of such meat as food, it will be necessary to advert to a chemical fact, which has not hitherto attracted the attention which its importance merits. The salt thus combined with the animal fibre ought no longer to be considered as condiment; a chemical combination has taken place; and although it is difficult to explain the nature of the affinities which have been brought into action, or that of the compound to which they have given origin, it is sufficiently evident that the texture of the fibre is so changed as to be less nutritive as well as less digestible. If we are called upon to produce any chemical evidence in support of such an assertion, we need only relate the experiment of M. Eller, who found, that if salt and water be boiled in a copper vessel, the solution will contain a notable quantity of that metal; whereas if, instead of heating a simple solution, the salt be previously mixed with beef, bacon, or fish, the fluid resulting from it will not contain an atom of copper. Does not this prove that the process of salting meat is something more than the mere saturation of the animal fibre with muriate of soda?

Vinegar, in small quantities, is a grateful and wholesome stimulant; it will often check the chemical fermentation of certain substances in the stomach, and prevent vegetable matter in its raw state from inducing flatulence; but its use requires caution, and in some morbid states of the system it is obviously improper. Fatty and gelatinous substances frequently appear to be rendered more digestible in the stomach by the addition of vinegar, although it is difficult to offer either a chemical or physiological explanation of the fact. The native vegetable acids may also be occasionally substituted: the addition of lemon-juice to rich and glutinous soups renders them less liable to disagree with the stomach; and the custom of eating apple-sauce with pork is, undoubtedly, indebted for its origin to the same cause. We shall take this opportunity to observe that vinegar, if taken in considerable quantities, as is not unfrequently the case with young persons, to prevent the accumulation of fat, is highly injurious to the digestive organs; and, if the habit be long continued, produces fatal marasmus.

The aromatic condiments comprise the foreign spices, as pepper, cayenne pepper, cinnamon, nutmeg, cloves, ginger; and the indigenous herbs and roots, such as parsley, thyme, sage, garlic, leek, onion, horse-radish, mustard, &c. The former of these were not intended by nature for the inhabitants of temperate climes: they are heating and highly stimulant. We are, however, not anxious to give more weight to this objection than it deserves. Man is no longer the child of nature, or the passive inhabitant of any particular region: he ranges over every part of the globe, and elicits nourishment from the productions of every climate. It may be therefore necessary that he should accompany the ingestion of foreign aliment with foreign condiment. If we go to the East for tea, there is no reason why we should not go to the West for sugar. The dyspeptic invalid, however, should be cautious in their use; they may afford temporary benefit at the expense of permanent mischief. It has been well said that the best quality of spices is to stimulate the appetite, and their worst to destroy by insensible degrees the tone of the stomach. The intrinsic goodness of meats should always be suspected when they require spicy seasoning to compensate for their natural want of sapidity. But, mischievous as the abuse of aromatic condiments may be, it is innocent in comparison with the custom of swallowing a quantity of brandy or an increased libation of wine to counteract the distress which supervenes on a too copious meal.

Oil.—This, with butter, constitutes what are called the oleaginous condiments. Melted butter is, perhaps, the most injurious of all the inventions of cookery: oil, when used in extremely small quantities, as a seasoning to salads, appears to prevent their running into fermentation, and consequently obviates flatulency.

II. ON THE PERIODS BEST ADAPTED FOR MEALS, AND ON THE INTERVALS WHICH SHOULD ELAPSE BETWEEN EACH.

Having offered a history of alimentary substances, and pointed out the general characters by which each species may be distinguished, we shall, in the next place, proceed to inquire into the various circumstances which may be capable of modifying the effects of food upon the human body, so as to promote, retard, or altogether to suspend the digestion of it; and first, with regard to the periods best adapted for meals. It is not extraordinary that a discrepancy of opinion should exist upon a question which involves so many fluctuating circumstances. Controversy upon this, as upon many other subjects of diet, has engendered a disbelief in its importance, and this scepticism has given a plausible pretext for indulgence on the one hand, and protracted fasting on the other, as the wishes or habits of mankind may have rendered most agreeable. We have been told that the best time for dining is, "*for a rich man, when he can get an appetite, and for a poor man, when he can get food.*" But appetite in health is regulated by habit, and in disease it acts but as an imperfect monitor. Certain general principles, therefore, deduced from observation and experience, must be laid down for our guidance, and these again in their application must be modified and adapted to the circumstances of every particular case; but before we enter upon this part of our subject, we must offer a few remarks upon the phenomena of *hunger* and *thirst.*

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* A pound of salt is generally added to each bushel of flour. Hence it may be presumed, that every adult consumes two ounces of salt per week, or six pounds and a half per annum, in bread only.

To account for the well-known sensation of hunger, various hypotheses have been framed, which it is not our present purpose to examine. The physiologists of the present day would appear to incline to the belief that it arises from the stimulant action of the gastric juice upon the nerves of the stomach; and to support this opinion, Dr. Wilson Philip relates the following experiment. A person in good health was prevailed upon to abstain from eating for more than twenty-four hours, and during that interval to increase the appetite by more than ordinary exercise. At the end of this time he was extremely hungry; but, instead of eating, he excited vomiting by drinking warm water and irritating the fauces. The water returned mixed only with a ropy fluid, such as the gastric juice is described to be. After this operation, not only all desire to eat was removed, but a degree of disgust was excited by seeing others eat. He, however, was prevailed upon to take a little bread and milk, which in a very short time ran into the acetous fermentation, as indicated by flatulence and eructation. Now, if this experiment proves anything, it merely shows that disturbance of the stomach, or of the nervous arrangements which are subservient to it, will destroy appetite for food; the existence of nausea, short of vomiting, will produce the same effect, and yet in this latter case the gastric juice is not removed: so, again, if a narcotic be applied to the nerves, their power is paralyzed, and the sensation of hunger ceases. Such an effect is produced by the juice of tobacco, although by long habit the stomach may become indifferent to its operation. Whenever the Indians of Asia and America undertake a long journey, and are likely to be destitute of provisions, they mix the juice of tobacco with powdered shells in the form of small balls, which they retain in their mouths, the gradual solution of which serves to counteract the cravings of hunger. Sir Walter Scott tells us that "General Monk, not being able to procure any supper at Coltstream, was fain to have recourse to chewing tobacco to appease his hunger." In like manner we may explain the operation of spirit in taking away the appetite of those who are not accustomed to it; while those who indulge the habit receive its stimulant without its narcotic impression. Lord Byron entertained a great dread of becoming corpulent, and on that account frequently abstained from food for several days together, appeasing his hunger by a wafer and a glass of brandy.

Although we do not mean to deny that the presence of a portion of gastric juice does not contribute to the sensation of hunger, it is quite evident that the phenomenon is intimately connected with an energetic state of the nerves, occasioned by an interval of inactivity, during which, when the organs are in a healthy condition, the vital powers may be supposed to accumulate. We might even venture to question the agency of the stomach so far as to contend that the sensation of hunger is seated in the ganglionic system; for we know from actual experiment that *nausea* is wholly independent of the stomach, since that sensation, as well as the spasm of retching, may be produced by the injection of tartar emetic into the veins of an animal, from which the stomach has been previously removed. Nausea, then, although, like hunger, it be referred to the stomach, is evidently independent of it; and if nausea can exist, why may not the opposite sensation of hunger, even though the animal should have lost its stomach by excision?

Natural appetite, which is only the first degree of hunger, never appears to recur until the aliment previously introduced has been duly assimilated. It cannot, therefore, strictly speaking, be said to have an immediate reference to the state of the stomach; for although all the chyme may have long before passed out of that organ, if any delay or embarrassment occur in its ulterior changes, appetite will not return, since the nervous energy being engaged in their completion cannot accumulate in the stomach; on the contrary, in certain diseases, as in tabes mesenterica, notwithstanding the presence of alimentary matter in the stomach, the appetite is never pacified, the subsequent processes being imperfect. These views are not introduced in this place for the purpose of encouraging fruitless speculation, but in order to establish a proposition of the highest importance in its relations to the theory of diet; viz. *that the several processes by which food is converted into blood cannot be simultaneously performed without such an expenditure of vital energy as weak persons are unable to sustain without mischief.* Thus, chylification would appear to require the quiescence of the stomach, and sanguification to be still more incompatible with the act of chymification. If, therefore, the stomach be set to work during the latter stages of digestion, the processes will in weak persons be much disturbed, if not entirely suspended. Certain circumstances cause hunger to return at nearer intervals by accelerating the nutritive process; while others, by producing an opposite tendency, lengthen such intervals.

It is a well-known fact that if a person be interrupted in his meal for a quarter of an hour, he finds on resuming it that his appetite is gone, although he may not have eaten half the quantity which he required; this probably arises from the food having entered upon those ulterior changes which are incompatible with the energy of the stomach.

The feeling of thirst announces to the individual the necessity of introducing a certain quantity of liquid into the system, in order to repair the waste which the body has sustained in the exercise of its functions, or to impart a due degree of solubility to the aliments which have been taken. We accordingly find that excessive perspiration increases the demand for it, and that dry food is followed by the same effect. The sensation is usually referred to the throat and fauces, but its intensity does not bear any relation to the dryness of those parts; for in some cases, where the tongue, to its very root, is covered with a thick and dry crust, there is little thirst; while, on the other hand, it is frequently intolerable at the very time the mouth is surcharged with saliva. We are inclined to refer the sensation to the cardiac or splenic portion of the stomach.[*] Dr. Gardner has remarked that, in the case of a person who had cut through the œsophagus, several bucketsfull of water were swallowed daily, and discharged through the wound, without quenching the thirst, which was afterwards found to abate by the injection of diluted spirits into the stomach.

All physicians advocate the necessity of regularity, both as regards the number of meals, and the periods at which they are taken. Those who have weak stomachs will, by such a system, not only digest more food, but will be less liable to those affections which arise from its imperfect assimilation; because, as Dr. Darwin has justly observed, they have in such a case both the stimulus of the aliment they take, and the periodical habit to assist the process. The periods of hunger and thirst are undoubtedly catenated with certain portions of time, or degrees of exhaustion, or other diurnal habits of life; and if the pain of hunger be not removed by taking food at the usual time, it is liable to cease until the next period of time or other habits recur. As these periods must vary according to circumstances in each individual, it frequently becomes necessary in civilized life to have recourse to intermediate meals, or luncheons; but to the dyspeptic patient such indulgences are rarely to be permitted. It is the more necessary to impress this precept upon the minds of invalids, as the anxiety of friends and the popular errors which exist upon the subject are too apt to establish the mischievous though specious aphorism of Sir William Temple, that "the stomach of an invalid is like a schoolboy, always at mischief unless it be employed." By such a system the natural process of digestion must, if our preceding views be correct, be constantly disturbed, and the healthy action of the stomach, as evinced by the return of moderate appetite, entirely prevented. But though the advantage of regular meals at stated periods is desirable, it has been much disputed how many ought to be allowed in the day: some physicians have considered one, others two, three, or even five necessary. It is, perhaps, impossible to lay down a general rule that shall apply to every particular case. In some persons the food rarely remains longer than three hours in the stomach; in others four, five, or even six hours. It is evident, then, that the repetition of the meals ought to be regulated by this circumstance; always avoiding the extreme of long fasting and repletion. Celsus recommends the healthy to take food rather twice than once in the day, and Sanctorius says, "that the body becomes more heavy and uneasy after six pounds taken at once than after eight taken at three meals," and that he who makes but one meal in the day, let him eat much or little, is pursuing a system that must ultimately injure him. When Plato returned that memorable answer to the philosophers who inquired whether he had seen any thing remarkable in Trinacria, "*vidi monstrum in natura, hominem bis saturatum in die*," he referred rather to the quantity than to the repetition of the meal of Dionysius. In our opinion, where the individual takes moderate exercise, three frugal meals may be allowed. It is reported that, when Alexander the Great turned away his cooks on proceeding upon a march, he observed that he had no further occasion for such assistants, as he carried with him superior cooks—a long morning's journey to create an appetite for his dinner, and a frugal dinner to give a relish to his supper.

Breakfast is, perhaps, the most natural and not the least important of our meals: for, since many hours must have intervened since the preceding repast, the stomach ought to be in a condition to receive a fresh supply of aliment. As all the food in the body has during the night been digested, we might presume that a person in the morning ought to feel an appetite on rising; this, however, is not always the fact: the energies of the stomach, although invigorated by repose, are not immediately called into action, especially in debilitated habits; it is therefore frequently advisable to allow an interval to pass before the meal. A question of some interest has arisen as to the propriety of taking a solid or liquid breakfast. We seem to have greatly departed from the custom of our hardy ancestors in this respect. A maid of honour in the court of Elizabeth breakfasted upon beef and drank ale after it; while the sportsman and even the day-labourer of the present day frequently breakfasts upon tea. The periods of their meals, however, were so generally different from those of modern times, that we cannot establish any useful comparison between them without taking into consideration the collateral circumstances which must have influenced their operation. It will not be difficult to show that liquids at this meal are essentially necessary. To say nothing of the instinctive desire we all feel for them, it is evident that there is a certain acrimony and rankness in all our secretions at that time; the breath has frequently a peculiar taint in the morning, which is not perceptible at subsequent periods of the day. The fluids of the body must have sustained a loss by perspiration, which experiments have shown to be double during sleep, a fact which in itself shows the propriety of a *liquid* breakfast.

Dinner.—Among the Romans this was rather considered as a refreshment to prevent faintness, than as a meal to convey much nourishment; but in modern times we need scarcely say that it is regarded as the principal meal, at which every species of luxurious gratification is indulged in.

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[*] Although the stomach is a single bag, it may be considered, with respect to its functions, as divisible into two distinct cavities; and these portions are, during the activity of the stomach, separated from each other by a peculiar muscular contraction. These chambers evidently appear to perform different offices in the process of digestion. The splenic portion would seem to separate from the food the superabundant water, and then to transmit the former to the pyloric division, where it undergoes its first great change. In the horse the mucous membranes of the two extremities of the stomach present even a striking difference of structure.

With regard to the proper period at which invalids should dine, physicians entertain but one opinion. This period is the middle of the day, or at about two or three o'clock, in order to afford a timely replenishment before the evening waning of the vital powers, and which naturally precedes the hour of rest. The exact period, however, of dinner must in some measure be directed with reference to the necessary habits of the patient, the nature and time of his breakfast, and, above all, to the rapidity or slowness of his digestion.

Ought we to take liquids at our dinner?—This question has been a fruitful source of controversy; but it appears to us to be very easily settled. By drinking *before* a meal, we place the stomach in a very unfit condition for the duties it has to perform. By drinking *during* a meal, we shall assist digestion if the solid matter be of a nature to require it, and impede it if the quantity taken renders the mass too liquid. It is evident that if the stomach be distended with fluid, the digestion of its solid contents must meet with impediment; its bulk will stimulate the muscular fibres to contract too rapidly, and thus to expel the food before it has undergone the necessary changes; while at the same time, if the solid matter be diffused through a large quantity of liquid, it cannot be so easily acted upon by the gastric juice; nor can it be readily converted into that pultaceous mass which appears to be a preliminary step to its digestion. On the other hand, if the food be too hard or dry, its necessary change by the *churning* of the stomach cannot be accomplished. It therefore follows that different aliments will require different quantities of liquid to assist their chymification. Animal food will demand, of course, a greater quantity than vegetable food; roasted than boiled meat, &c. The best, and perhaps the only test of the necessity of liquid during dinner is to be found in the sensations of the individual, which ought never to be disregarded because they appear in opposition to some preconceived theory. If our food possess that degree of succulence which characterises digestible aliment, there will seldom be any occasion for drink; but, on the contrary, where the mass is too dry, the stomach will give us notice of it by the creation of thirst. But, under any circumstances, the quantity taken should be small; it is during the intervals of our solid meals that the liquid necessary for the repair of our fluids should be taken: and this brings us to the consideration of the next repast.

Tea.—Theory and experience both conform in demonstrating the advantage which attends a liquid repast a few hours after dinner. At this period the chyle has entered its proper vessels, and is flowing into the blood, in order to undergo its final changes. Then it is that the stomach, having disposed of its charge, receives the wholesome draught with the greatest advantage; then it is that the blood, impregnated with new materials, requires the assistance of a diluent to complete their sanguification, and to carry off the superfluous matter; and it is then that the kidneys and the skin will require the aid of additional water to assist the performance of their functions.

Supper.—In the time of Elizabeth, the nobility and gentry were accustomed to dine at eleven, to sup between five and six, and to retire to rest at ten. It is therefore evident that any argument in favour of this meal, founded upon the healthy condition of our ancestors, cannot avail. By supper, in modern times, we mean a meal just before bed-time; but as sleep is not favourable to every stage of digestion, it is very questionable whether retiring to rest with a full stomach can, under any circumstances, be salutary. During the first part of the process, or that of chymification, a person so situated may perhaps sleep quietly, unless, indeed, the morbid distension of the stomach should impede respiration, and occasion distress; but when the food has passed out of the stomach, and the processes of chylification and sanguification have been established, the natural propensity of the body is for activity, and the invalid awakes at this period, and remains in a feverish state for some hours. Upon this general principle, then, suppers, that is to say, *hearty* suppers, are to be avoided. The same objection cannot be urged against a *light* repast, which is often useful to dyspeptics; and it has been truly and facetiously observed, that some invalids need not put on their night-cap if they do not first bribe their stomachs to good behaviour.

On the quantity of Food that ought to be taken at different meals.—Nothing can be more absurd than to establish a rule of weight and measure upon such occasions. Individuals differ from each other so widely in their capacities for food, that to attempt the construction of a universal standard would be little less absurd than the practice of the philosophical tailors of Laputa, who, the reader will remember, wrought by mathematical calculation, and entertained a supreme contempt for those humble and illiterate fashioners who went to work by measuring the person of their customer; but Gulliver tells us that the worst clothes he ever wore were constructed on abstract principles. How then, it may be asked, shall we be able to fix the proportion of food which it may be proper for an invalid to take? By desiring the patient to attend carefully to the first feeling of satiety. There is a moment when the relish given by the appetite ceases; a single mouthful taken after this oppresses a weak stomach. If he eats slowly, and carefully attends to this feeling, he will never overload the stomach; but, that such indication may not deceive him, let him remember to *eat slowly* and to *masticate* thoroughly. This is an important condition; for when we eat too fast, we introduce a greater quantity of food into the stomach than the gastric juice can at once combine with; the consequence of which will be, that appetite may continue after the stomach has received more than it can well digest.

On the conduct to be pursued previous and subsequent to Meals; and on the relations of Diet to the Non-naturals.—We do not intend to assert that Nature ever contemplated the necessity of confining men to a certain routine of habits; nor did she ever contemplate, as far as we can learn, the existence of those diseases which may render such discipline necessary. We have in this place only to inquire into the habits which are most favourable or hostile to the process of digestion, and then to form a code for the direction of those who may stand in need of such artificial assistance. We have therefore to consider the influences of air, exercise, sleep, and the passions of the mind.

Exercise in the open air is essential to the well-being of every one; but its degree must be regulated by circumstances. The interval between breakfast and dinner is the period for active exertion, and the enjoyment of it, when not attended with severe fatigue, will strengthen and invigorate all the functions of the body; but it is important to remark that *the valetudinarian and dyspeptic should never take his principal meal in a state of fatigue*: and yet what habit is more general? Every body is impressed with the belief that after the sedentary occupation of the morning, to take a long and fatiguing walk will sharpen the appetite and invigorate the digestion: the consequence is obvious; instead of curing, such a practice is calculated to perpetuate and even to aggravate a dyspeptic malady; for the powers of digestion will be thus summoned at a period when the vital energy of the body is exhausted. We are anxious to be clearly understood upon this point: let it not, therefore, be supposed that we decry the use of moderate exercise before dinner; it is only the abuse of it we are so anxious to prevent. No person should sit down to a full meal unless he has previously inhaled the open air, and taken a quantity of exercise proportionate to his power of sustaining it without fatigue.

If exercise be necessary previous to a meal, there is also a certain period after it at which the accomplishment of the last stage of digestion will be accelerated by it.

When the chyle enters the blood, the body becomes enlivened; while the stomach and small intestines, having been liberated from their burthen, oppose no obstacle to the free indulgence of that desire for activity which Nature has thus instinctively excited for our benefit. Then it is that animals are roused from that repose into which they had subsided during the earlier stages of digestion, and betake themselves to action; then it is that civilized man feels an aptness for exertion, although he mistakes the nature and object of the impulse, and is inclined to regard it as nothing more than a healthy sensation, by which he is summoned to that occupation to which inclination or duty may prompt him. Thus, instead of being *bodily* active, the studious man receives it as a summons to mental exertion; the indolent man, perhaps, merely to sit up and enjoy himself; the libertine to commence his libations; and the votary of fashion to attend the crowded circles of gaiety and dissipation. In short, this feeling of renovated energy is used or abused in a thousand ways by different individuals, without their ever dreaming that *bodily exercise*, and *that alone*, is implied by it. The result of this mistake is, that imperfect assimilation and all its train of evils follow. In this respect our ancestors enjoyed a great advantage from their early hours; they were enabled by them to take exercise at the most advantageous periods of the day; even the ball-room, which in our days might be termed Death's ante-chamber, was not injurious;—with them the dance commenced at six and terminated at eleven; with us it begins at eleven and ends at six!

If exercise be useful during the period of sanguification, pure air is not less so; and we may take this opportunity of protesting against the custom of frequenting crowded and ill-ventilated apartments at the very hour when the body requires the purest air for the sanguification of the aliment which has been recently taken into it.

Sleeping after dinner is a practice of very questionable propriety: it is true that the inhabitants of many southern climates indulge in it with impunity; but it does not appear essential in this country, where animal food is used in such considerable quantities. Its effect is to hurry on the different stages of digestion; and hence the fever and state of excitement in which the person not unfrequently awakes. In states of disease, it may occasionally be useful, and the recumbent posture may expedite the passage of the aliment out of the stomach; but we should recommend those who indulge in such a habit to remove all ligatures from the body.

Passions of the mind, such as fear, anxiety, and rage, are well known to affect the nervous system, and, through that medium, the stomach and functions of the digestive organs; and so immediately are their consequences experienced, that a person receiving unpleasant intelligence at the hour of repast is incapable of eating a morsel, whatever might have been the appetite before such communication.

> "Read o'er this;
> And after this; and then to breakfast
> *With what appetite* you may."

In directing our attention to the *excretions*, we must not overlook the sympathy subsisting between the skin and stomach. If the cutaneous vessels be universally excited, and this excitation be long continued, they will at length fall into a state of indirect debility, whence a sense of faintness, loss of appetite, and the inability of digesting solid food will be experienced. This fact explains the diminished appetite of which persons complain in hot weather, and that universal custom in tropical climates of combining the food with large quantities of aromatic stimulants. One of the most striking instances indicative of this consent between the skin and the stomach is to be found in cases where cold or wet has been applied to the lower extremities. The following is an extract from a letter received by the writer of this article, from Dr. John Badeley, of Chelmsford:—"A gentleman who consulted my father, complained that on getting out of bed in the morning, and putting on his leather breeches, he constantly vomited, from the sensation of cold thus occasioned. My father recommended him to take a glassful of cold water before he commenced dressing, and it was found effectual. The gentleman never afterwards vomited upon these occasions."

But it is necessary to conclude this essay. We have endeavoured, in the shortest possible compass, to develope the philosophy of the subject of dietetics, and, as far as our present knowledge extends, to point out the chemical and physical varieties of structure and composition which confer upon different articles of nourishment their relative, nutritive, and digestible qualities. In the article Regimen we shall endeavour to apply this knowledge to the treatment of individual diseases. No general rule can be given for the guidance of the physician in such cases. Every such attempt must be a failure: it may foster quackery, and perpetuate popular error, but it can never advance the progress of that pure and simple science which it is the object of these pages to inculcate.

J. A. Paris.

DILATATION OF BRONCHI.—See Bronchitis, Chronic.

[DILATATION OF THE HEART.—See Heart, Dilatation of the.]

DISEASE. Disease is disordered action of any part of the machinery of the body, [or it is, an altered condition of structure, or function, or both, in some part of the organism.] Its primary effects, or perhaps we would say, its primary palpable phenomena, are impeded or disordered functions; and of these the results are alterations of structure, and various symptoms or signs indicative of functional and of structural changes.

There is a state of the different systems of which the body is composed, in which all the functions of life are performed with comfort and ease, and a sense of well-being. This is the state of health. Whenever any bodily or mental function is not performed thus harmoniously, there is an interruption of this state, however slight the departure from the condition of health may be. The first symptom of this slight disease, for such it is, is mere discomfort. As the disorder proceeds, if it does proceed, from this slight beginning, the discomfort is succeeded by pain and various other circumstances, which are all consequently so many symptoms of disease. Thus the slightest disordered action may produce only inconvenience; as nausea, vertigo, pruritus: and increased disordered action will produce increased inconvenience; vomiting, loss of sense, cutaneous inflammation, with the additional symptoms of pain. On this aggravated state changes of structure supervene. It occasionally happens that functional disorders, because they in such cases affect parts of a low degree of sensibility, proceed far, even to structural alteration, with nothing more than symptoms of occasional discomfort; but these instances are not frequent.

Compatible with the state of health, also, are considerable varieties in the performance of certain functions. They do not interrupt health so far as to produce even discomfort. The pulse of some individuals is never beyond 50, and of others never below 110. In some the function of digestion is more rapidly and actively performed than in others: and the intellectual alacrity of different persons is well known to be widely different, yet without disease. But when the food is not digested without discomfort or pain, or the circulation not carried on, or the mental movements not made, without similar results; when the appetite is lost, when there is fainting, when there is privation or other affection of any of the sensations or mental faculties; then there is disease.

The least consideration shows us that man is exposed to various circumstances capable of disordering his functions, and all these circumstances are so many *causes* of disease. They are found in the elements by which he is surrounded; in the food on which he subsists; in excess or defect of voluntary exercise; and in the nature of his mind, sensations, and affections, which subjects him to various kinds of risk by prompting various actions and enterprises, and which is susceptible of impressions as well as capable of originating such actions. Man is also liable to connate and inherited defects, and to diseases resulting from the natural decay of his bodily frame.

The element to which man is chiefly and at all times exposed, is the air. Its variable temperature, dryness, and moisture; its alternations of calmness and commotion; and probably, also, its variable electrical states; not only immediately affect the surface and the respiratory organs, but through the latter the blood, and through that fluid the energy of all parts of the system. Some of the variations seem to have a direct influence on the nervous system; and there are presumable properties in the air, yet unknown save in their destructive effects, which are largely concerned in the production of our common continued fevers, the yellow fever, the plague, the intermittents of fenny countries, cholera, and what is called influenza. No doubt can be entertained of the agency of such atmospherical influences in the production of the common eruptive disorders; and of one at least of the disorders characterised by irritation of a particular portion of the nervous system (the respiratory), and by spasm,—circumstances exemplified by the hooping-cough. The direct influence of the air on the nervous system is not easily proved; but to this, or to some effect produced on the fluids or solids of the body, together or separately, must be ascribed the variations of feeling and spirits experienced by so many individuals in variable states of the weather, and the suicidal despondency which medical travellers have found to be induced by the sirocco. (Dr. J. Johnson.) The condition of certain structures of the body, and perhaps of their nerves, is seen in the course of the seasons to be materially affected by certain states of the atmosphere: the effects being sometimes, apparently, merely the result of temperature, as in the catarrhs, and disorders of the respiratory and circulating apparatus in the cold weather of severe winters; but at other times more obscure, as in the irritability of the mucous membrane of the stomach and intestines in the summer and autumn, of which the consequences are periodical dyspepsia, gastric fevers, diarrhœa, dysentery, and cholera. Of diseases thus obscurely arising, some, peculiar to particular localities, are called endemic; others, appearing and disappearing at particular seasons with some regularity, are called epidemic, and many of the latter become under certain circumstances communicable from one individual to another.

Several of the occupations of man in civilised countries are carried on in confined and ill-ventilated places, where the mere assemblage of many persons deteriorates the quality of the air: the effect of breathing this is very injurious to health, and a very common cause of disease. The influence of a high temperature, combined with excessive moisture, has been abundantly experienced in the diseases incidental to tropical climates. There are also occupations in the course of which light particles of foreign matter are mingled with the air and inspired; as needle-pointing, grinding of corn, and mason's work; and these particles cause irritation and disease.

In the quality and in the quantity of food are found also the causes of disease. Some kinds of food produce disorder by their stimulating properties, and some by otherwise inducing departures from healthy processes, as in the example of calculous formations in the kidneys. Man is equally disordered by excess and defect of nutrition.

Excess or defect of voluntary exercise and rest affects him no less. It is the rule of nature that voluntary muscular action cannot be neglected with impunity; and its excess produces direct exhaustion.

Many familiar facts, not uninteresting to the medical observer, illustrate the effects of certain species and measures of diet, and peculiar kinds and degrees of exercise, upon the human body. The corpulence and fatness of coachmen and farmers, and the thinness of students and of foot-soldiers, may afford him instruction. But the effects of what is termed *training*, both in increasing and decreasing the bulk and strength of the body, and the vigour of the mind, are more especially deserving of attention. By the administration of dry and very nutritious food; by a certain degree of exercise in the open air; by allowing a moderate portion of sleep; and by avoiding every kind of excess; assisted, however, it should be said, by great attention to the state of the surface, and by a little preparatory purgative medicine; the athletæ of old, and the prize-fighters of modern times, have been accustomed to attain such a corporeal condition in the course of six or eight weeks as to endure great fatigue, to breathe freely and fully under extreme exertion, to bear violent blows on the head without giddiness, and to incur severe wounds without danger or long inconvenience. The appetite, after such a system of training, becomes great; the skin becomes of a better colour; and the shape of the body improves. A man thus disciplined can not only run twenty or thirty miles with ease, or walk a hundred, but can face dangers which would before have appalled him; and wrestle or contend advantageously with an assailant by whose strength he would previously have been overpowered. It is said, too, that the perceptions become more acute, and the mental faculties more active; but such consequences are of course not always observed among those who are commonly the subjects of training, although in their gaming devices they not unfrequently show great acuteness and power of calculation. These effects of training are commonly very transient, and repeated or excessive training seems to shorten human life. It is a question, however, how far this supposed hurtful effect of training is to be ascribed to the intemperate habits of the persons usually submitting to training. Race-horses and game-cocks, which are also subjected to particular training, are not found to be shorter-lived than other animals of the same species.

By methods entirely opposite, the reduction of strength and of bulk may be effected in a very short space of time. The boys employed as jockeys at Doncaster and Newmarket are sometimes reduced twelve or sixteen pounds in weight in the course of ten days, in order to ride a particular race. They are not allowed during this preparation to have meat, or wine, or ale; but live on fish, and puddings, and bread and butter: they have tea at night, but nothing to eat with it. With this slender diet is conjoined strong exercise in thick and heavy clothing. After the race is run, the jockey is allowed to indulge himself; and it is said that as much as nine pounds in weight have been regained in eighteen hours. The effects of this reduction of weight and strength on the brain, as exemplified in the intellectual manifestations, have not been noticed; but it is said that the constitution is often ruined by these vicissitudes. Many jockeys may be observed to be stunted in growth, and to have, even in the prime of life, the dry and withered appearance of premature old age.

It is worthy to be remarked, that not only do excess in diet and extreme abstinence, too much rest and excessive fatigue, extremes of heat and extremes of cold, disorder the body; but that they all seem, when carried to the utmost, to affect the body in the same, or nearly the same manner. All (perhaps by impairing the functions of the nervous and vascular systems) eventually induce those disturbed actions which constitute febrile disorder. In fact, what is called *re-action*, under most circumstances, consists of the establishment of actions tending to febrile or inflammatory processes; and probably the converse, namely, that inflammations and fevers are commonly intended to rid the body of some inconvenience, is not far from the truth.

The great gift of the mind, also, by which man is so greatly raised above the lower animals—by which he inquires, improves, records his improvements, and looks beyond this life—is a gift that his imperfect nature cannot bear without the tribute of occasional inconveniences, from which the less privileged animals are exempt. Its inordinate exertion, and the vehement impressions of which it is susceptible, exhaust the nervous energy, or impair the nervous actions, or alter the actual condition of the nerve; and thus deprive the physical part of the system of some of its power, increase its susceptibility, disturb the processes which should be performed in the different bodily organs, and bring on disease, or gradually enfeeble the whole system. From such causes we perceive, in different cases, various irregular actions, chiefly exemplified in the muscles,—agitation, tremor, faltering voice, unsteady gait, spasm, hysteria, epilepsy;—or exemplifications of diminished power, as in the various shades of paralysis.

By sloth and negligence, or by irregularity and prodigality of application, the powers of the mind itself are equally impaired in some cases, and in others disturbed. Sudden and excessive joy exhausts the mental and nervous power at once; and sudden and overwhelming sorrow oppresses both beyond recovery, producing a state which is sometimes followed by that deep sleep which restores the capacity of endurance, and sometimes by that sleep which ends all worldly suffering.

The influence of sudden mental impressions on what is called determination of blood to the head, one may have vertigo, another pain; one may have a fit of epilepsy, and one die apoplectic. The difference in the effect may be occasioned by a difference in the power of the exciting cause, or in the violence of the determination; or, the determination being equally violent in all, the different effect may depend on the peculiar susceptibility of each.

There are certain cases in which disease appears to be produced simply by the application of an exciting cause, without the existence of a cause predisposing. There are others in which an exciting cause often seems to be wanting. These inconsistent phenomena, however, are to be ascribed to our imperfect knowledge of some of the causes. A violent burn, a wound, or other accident, will produce inflammation of various tissues, with no other predisposing cause than the nature of the human constitution. A child, in a particular condition of atmosphere, will become affected with hooping-cough or measles; and the predisposition is here also inherent in the constitution of the body. When the predisposition is removed, as in ordinary cases it is, by the occurrence of these disorders, the child may be exposed to the exciting cause, the peculiar condition of the air, with complete impunity. The cases in which disease seems to arise without an exciting cause, are chiefly those of morbid formations, in which such cause exists in the supervention of certain actions not yet understood.

FORMS OF DISEASE.—Diseases, however various or complicated, or whatever are their terminations, admit of a division into two great primary classes; the first comprehending all *disorders of function*; the second all *morbid products*.

Disorders of Function.—The view taken of this class by the general pathologist is one which is continually enlarging with the progressive improvement of physiology. Its leading features may be spoken of in connection with the two most important symptoms of the body, the vascular and the nervous. Nearly every disordered action which can be conceived to exist, must be intimately connected with some irregularity in one or both of these systems.

1. In the *vascular* system we observe, *a.* local determinations or local accumulations of blood, productive of an excess of supply, with excitement of the part supplied in excess; or congestion, with oppression of the part congested. *b.* Local defective supply of blood, producing or contributing to produce, defective secretions, defective energy, external discoloration, and a tendency to other disordered actions. Of these may be mentioned as examples, defective supply to the breasts or uterus in feeble women; to the hair in old or sickly persons; to the brain and other organs in those convalescent from fever; and to the feet in diseased or aged persons, with a tendency to mortification. *c.* General excess of blood, or plethora; the results of which are very various: *e.g.* increase of natural secretions, exhalations, and the vigour of different functions; irregular actions; excessive growths; and, perhaps, other morbid formations. *d.* General defect of blood, or anæmia. *e.* The state of the blood-vessels in inflammation, whether common or specific, as in croup, &c. *f.* The state or actions of the blood-vessels in misplaced and new formations, including altered conditions of the blood contained in them.

2. In the *nervous* system we equally observe excess, defect, and irregularity of distribution. *a.* Local excess of nervous power; a state often accompanied with excessive sanguineous supply, but not invariably. To this excess of nervous power we cannot but attribute some of the instances of increased sensations and increased muscular actions in maniacal and hysterical persons. In the cases of increased secretions, increased absorption, increased nutrition, and increased evacuations; comprising the unusual flow of tears, or bile, or urine; the sudden disappearance of dropsical accumulations; hypertrophy of organs; diarrhœa, and excessive perspiration; a mixed explanation must be admitted: and in most of these circumstances, or perhaps in all except that of increased absorption, there appears to be a simultaneous excitement of the nerves and the blood-vessels. *b.* So, also, the general excess of nervous power, or general nervous excitement, is not often seen distinct from excitement of the vascular system. Either, first existing, seems to induce the other. The nervous excitement may, however, exist first, and therefore separately. *c.* The general defect of nervous power is shown in the weary and exhausted, and in some forms of incipient paralysis. It is observed in many other instances, but generally co-existing with defective power of the vascular system. *d.* Local defect of nervous power is seen in persons affected with tremors, chorea, and partial paralysis; in idiots and lunatics, whose intellectual actions are weak, impeded, or disordered, whilst their digestive powers are often unimpaired or even increased. It is observable also in the sick, the feeble, and the aged, and is one of the most ordinary precursors of death. The instances of deficient secretions, deficient nutrition, and deficient evacuations, are, as the reader will suppose after what has already been said, to be viewed generally as the consequences of a simultaneous defect in the nervous and vascular actions. If it be admitted that the action of the absorbents depends on the nerves, deficient absorption would in some instances appear to depend on defective nervous supply to the absorbent vessels. It is highly probable that some of the disorders of the function of respiration depend on deficient actions in the respiratory nerves. In some of the instances of chorea, as in tetanus, and in hydrophobic convulsions, the disorder of the nervous system probably consists of excess, or of irregularity, rather than of defect. *e.* There is, apparently, a morbid condition of the nerves in all inflammations, and evidently in some, as in gout. *f.* There are probably disordered nervous actions, in no degree yet understood, concerned in misplaced and in new formations, including altered states of the blood itself.

One very important example of general disordered action has been left out of this enumeration, namely, *fever*. Its place must depend on the yet undecided question of its actual nature. The vascular and the nervous depression, and the subsequent excitement of both the blood-vessels and nerves, are sufficiently evident. But not only is the order of these phenomena yet undetermined, but their relation to a primary impairment of the vitality of the blood at least not disproved. For this reason we pass on to the *second* great class of diseases, or morbid products.

Morbid Products.—These may exist in the solid or in the fluid components of the body. They probably seldom arise from disorder of one of the great systems without coexisting disorder of the other. In their characters they vary exceedingly, as will be made apparent by the following, which is still an imperfect enumeration of them.

a. The effects of simple determination of blood, or local excess, which seems to be not only in many cases an increase of natural discharges, but alterations in their properties. These have not been very closely investigated. The sudden, profuse, and watery discharge from the mucous membrane of the nostrils incidental to some individuals from slight causes, and distinct from common coryza, affords an example of this class; and sudden evacuations from the skin, or bowels, may be also mentioned. The redundant growth, or hypertrophy of organs, demands, for one of its accompaniments, or rather one of its causes, this increased determination of sanguineous material; but such departures from the natural state should perhaps be classed in another division (*c*). Active hemorrhages are another consequence of increased determination to particular parts.

b. The effects of inflammation;—serum, lymph, false membranes on serous surfaces, pus, thickenings of parts by intestinal depositions, gouty concretions, the diphtheritic formations on mucous membranes, as in croup, and in inflammation of the mucous lining of the intestines or the vagina; and the peculiar matter found in scrofulous glands.

c. Natural secretions or formations misplaced;—bone in soft parts, as in the membranes of the brain, in the heart, in the blood-vessels; fat about the heart, or in the substance of the liver; misplaced fibrous tissue, cartilage, cellular tissue, hair, nails, serous tissue (in certain tumous, *Bichat,*) mucous tissue (in fistulæ, *Hunter,*) enamel (in some diseases of the joints), synovial membrane (in false articulations), arteries, veins, and nerves (in some tumours): These misplaced productions are often imperfect. They do not necessarily endanger life, although they are often inconvenient, and sometimes dangerous, in consequence of their situation or the size to which they attain. In certain cases they are formed for the preservation of life; as in the case of the fibrous masses formed in aneurism, and of the cysts or boundaries of abscesses.

d. Altered secretions;—soft or fragile bone; acrid bile; the disorders of the urine accompanying calculous formations.

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Theories of Disease.—These observations bring us immediately to the great question of the *origin* of these important departures from health; not only as regards the new products of disease, but the misplacements and excess and depravation of some of the natural products; the solution of which cannot precede the determination of some unsettled questions in physiology. When the laws and processes of secretion are clearly demonstrated, the next step will be an accurate knowledge of the diseased actions in which morbid products originate.

The alterations occurring in the fluid parts of the body, but particularly in the blood, which once attracted so much attention as to be the general basis of a pathological system, have recently, after experiencing the capricious neglect to which many doctrines containing much truth have at different periods been subjected, again drawn towards them the anxious attention of philosophical physicians. (See the article Blood.) The vital and, as it were, independent properties of the blood are no longer overlooked, and the important office performed by this fluid in relation to the secretions, an office extending beyond the mere supply of a material for their formation, directs the inquiries of the pathologist towards those intimate changes which, taking place within the arteries, or even in organs contributing to the unexplained function of the hæmatosis, are the real causes of the singular and abnormal products presented by various diseases. Thus we may in the present time perceive the dawn of a new humoral pathology, more correct, and at the same time less exclusive, than that which from the age of Hippocrates down to nearly the end of the seventeenth century prevailed throughout all the schools and doctrines of medicine. Without reverting to the dreams of the mathematical physicians, the doctrine which ascribed so many of the phenomena of disease to the *moving powers*, will not be discarded; and even the first changes traceable in the blood itself may be acknowledged to depend upon irregularities in actions of which the very existence is yet in the utmost degree obscure.

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When it is considered that five-sixths of the materials of the body are fluid; that all the materials even of the solid parts primarily exist in a fluid state, and are again reduced to fluidity before their ultimate removal; it is quite in vain to deny the importance of paying attention to diseased states of the fluids. But physiology teaches us that the formation of the fluids depends, no less than that of the solids, on certain preceding actions, and that the disturbance of these actions is often known to be, and may probably always be, antecedent to the diseased condition of the fluid parts.

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* In a case of hypertrophy of the heart, the patient's perspiration tinged his linen, and the lining of his hat, of a *red* colour.

In some circumstances the blood is seen to be so suddenly deprived of its vitality, that the primary impairment of that vitality in other cases where there is a long series of morbid phenomena, becomes exceedingly probable. When death is occasioned by lightning, by a violent blow, or by the poison of a rattle-snake, and sometimes even by the unknown poison which produces a sudden and violent attack of fever, in which the patient dies without re-action; the most palpable disorder is effected in the blood itself, which is found to be deprived of its natural and vital properties. The change in these cases is so instantaneous, that even if we admit an antecedent change in the nervous actions, we admit what we are at least unable to demonstrate. Recent observations have made it highly probable that in a severe attack of the spasmodic cholera, the serum and some of the saline constituents of the blood are forcibly separated from the red globules.

In the instance of melanosis, some pathologists have considered the black formation to be a deposit from the blood, which has previously undergone some peculiar change. The growth of polypi may perhaps be attributed to some change by which the fibrine is separated from the blood.

In other cases, where the duration of less violent phenomena is more prolonged, as in the case of eruptive fevers, we have every proof of the action of the first cause of the disease upon the fluids. In the small-pox we are enabled to communicate the disease directly through the blood to the whole system.

The great respectability of the authorities which might be ranged on one hand as supporters of the doctrine of fever being produced by an atmospheric poison acting upon the blood;—and, on the other hand, as supporters of the doctrine which, admitting the sanguineous changes and their consequences, assert the primary action of the febrile poison on the nervous system;—very forcibly shows the difficulty of determining the question by observation, and in the present state of physiology, of unravelling the intricate implications of the nervous and vascular systems in the performance of healthy, and consequently of diseased actions. Any one acquainted with the present state of medical science, and possessed of some share of ingenuity, might construct a plausible theory by attaching himself to either one or the other of these great systems. The more palpable indications of disorder, although that disorder is often but re-action, would probably cause the number of those espousing the *vascular* theory to be the most considerable; whilst the undefined limits of nervous influence would give to the *nervous* theory all the advantages to be derived from bold and unrestrained conjecture. In the mean time, a true and permanent doctrine would still be eventually found to lie between these extremes, and to be founded on the triple basis of cotemporaneous disorders of both the great systems, and on the occasional primary affection of either one or the other.

At no period since the first cultivation of medicine have physicians ever been so free from any predominant and absorbing theory of diseases as at the present time. So great, indeed, has been the zeal with which facts and cases have been collected, that the age is somewhat open to the reproach of having reasoned upon them too little. Yet, when it is considered how indispensable to a correct system of pathology is a previous enlargement of certain parts of physiological science, it ought to be matter of praise rather than of censure that the physicians of the present day so much abstain from premature conclusions. When the physiologist can explain the formation of the several secretions from the blood, and the workings of the fine apparatus by which these formations are effected, and new parts formed, while old parts are carried away;—when the relative dependences of the nervous and the vascular systems are determined, and the chemistry of the animal fluids in disease as well known as is that of their normal state, then, and then only, will the doctrine of the intimate nature of diseases become exact.

One or two of the general theories of disease, however, which have been prevalent since the commencement even of the present century, may be alluded to. A great majority of the pathologists of this country, who ascribe disease to disordered actions, for a time adopted the views of the late Dr. Parry, of Bath. He was a physician of great talents and great industry. Amidst the fatigues of a large practice, and many interruptions from ill health, he found time to make observations upon almost every form in which disease presents itself; and he proceeded a considerable way towards forming these observations into a great system. Perceiving the error of the older practitioners, who, in their attention to nervous phenomena, overlooked their frequent dependence on vascular disturbance, he rejected, most certainly in terms too positive and unqualified, all idea of a nervous theory, and looked for the origin of almost all diseases to some irregularity in the powers which move the blood. This theory was actually applicable to so many and such severe affections, not a few of which had been previously misunderstood and very erroneously treated in practice,—and it was moreover so specious and so convenient, that it promised fair at one time to be universally adopted. There were few forms of disorder in which it seemed very difficult to admit, either that the impetus of the blood in the organs chiefly affected was morbidly increased, or, without general disturbance of the circulation, the tonicity of the arteries proceeding to such organs was diminished, their elasticity preponderant, and their resistance to the usual momentum of the current of blood morbidly decreased. In either of these cases, one of which was often capable of demonstration, whilst the other always admitted of supposition, and not unfrequently existed, the morbid phenomena present in each case were ascribed to undue determination of blood.

Of many diseases the first palpable phenomena are affections of the vascular system. But that there are morbid actions in which, even when visibly increased or disordered vascular action is present, it is but an accompaniment, however inconvenient and even hurtful, is sufficiently evident. The mere disorder in the circulation will not account for the various morbid processes incidental to the scrofulous constitution, or for many of the affections of the digestive, respiratory, mental, and other functions. With all our respect for Dr. Parry, and there are few authors for whom we entertain a respect more sincere, it is impossible to go along with him, when, as if to show his theory in the most advantageous point of view imaginable, he speaks of "that increased determination of blood to the lower extremities which constitutes gout." (Elements of Pathology and Therapeutics, ccccl vi.)

We cannot, in short, possibly exclude the idea of a peculiar constitution of nervous substance, or modification of nervous action, although such constitution and modification are only perceived by certain effects for which no other satisfactory cause can be assigned. If such a pathology be still imperfect, it is only so because physiology is circumscribed. When the nature of that nervous power or influence is understood, which in one part of the nervous substance effects motions in other structures, in another part permits sensation, in another volition, in another the internal sense which governs some of the most important animal processes, and in another all that we call intelligence, then may the pathologist presume to hold a bolder language, for he will then advance to facts with which he is at present quite unfurnished and unaided.

In the mean time, the pathological connection between the two great systems, of which illustrations have been already given, are even now not neglected in practice. The relief of some nervous disorders is attempted, and often effected, by means acting primarily on the vascular; as in the case of hysteria, in which venesection is so frequently more serviceable than any of the means which are considered to act immediately on the nerves. There are cases of inflammatory disorder in which the best auxiliaries of blood-letting are sedatives, which seem simultaneously to allay nervous and vascular irritation. Attempts are alternately made to check the progress of morbid formations, as of scirrhus, by lessening the supply of blood to the part affected, and by soothing the nervous system. In phthisis pulmonalis, we endeavour to decrease the general momentum of the blood, or the irritability of the heart and arteries, without repeatedly lessening the general quantity of the blood; and the means employed, as, for instance, the digitalis or the hydrocyanic acid, seem to act on the whole vascular system by first acting on the whole nervous system. These are so many exemplifications of a liberal and philosophical theory of diseases, which, without being formally avowed, appears to us to have been acted upon for many years past, in this country, in a variety of disorders. It is not unpleasing to observe with how little pomp such a system has gradually spread its rational influence over British practice; its unpretending character arising apparently from its being little more than a reflection of undeniable facts.

The strong disposition of the human mind to rest and generalize after the fatigue of acquiring or observing a limited number of facts, has even divided into at least two sects those who ascribe disease to disordered actions; and these, adopting a nervous or a vascular theory, are only distinguished by the particular position they have selected, by the particular facts or phenomena on which they take their stand, and which they believe in every case of disease to precede all the rest. A few, and but a few, of the distinguished teachers on the continent yet cling to the assertion that all disordered actions must be preceded by organic or structural change; an assertion implying too complete a reversal of the order of observable phenomena to require any discussion. But a much larger sect is composed of those who ascribe all morbid phenomena, all disease, all structural change or new formation, all disordered action, to some shade or other of inflammation; rather, it is to be apprehended, from a misapplication of language, and the too licentious extension of the term inflammation, than from a real and unqualified proselytism to so sweeping and unphilosophical a generalization. Another sect, the followers of M. Broussais, whose talents, unbounded confidence in himself, and vehement eloquence, have attracted some and scared others to swell the number of his disciples, acknowledge no other origin of the most remote diseases than disordered action, irritation, or sub-inflammation of the mucous lining of the intestinal canal; a plausible doctrine, resting on numerous facts, and largely intermingled with truth, but which becomes useless or unsafe when it is made universal.

But whilst almost all the schools of Europe, and we may add of America, have been distinguished by a calm and philosophical spirit, averse to mere hypothesis, and little addicted to implicit adoption of the tenets of any single master—*nullius addictus jurare in verba magistri*,—a sect has arisen in Germany, chiefly consisting of men whose enthusiasm far outruns their powers either of observation or of reasoning, and embodied under the appellation of Homœopathists. To omit all notice of this sect might be considered improper in so general an article as the present; yet to speak of their opinions and practice without departing from the ordinary style of medical discussion is somewhat difficult.

Not without the credit of having pointed out some unnoticed circumstances connected with the administration and effects of medicines, and even deserving of some praise for having enforced a few salutary maxims of diet and of regimen; the founder of this sect, Dr. Samuel Hahnemann, surpasses all the heads of all the sects that ever flourished, or that have been forgotten, in the boldness of his assertions, the careless extravagance of his deductions, and the scorn with which he regards all whom he fails to persuade.

According to the doctrine thus presented to the hitherto deluded followers of physic, the art of curing diseases consists of the employment of medicines in each case, which, in a person in good health, would produce a similar disease. There is, we think, an ancient proverb which comprehends the grand principle of homoöpathie, "what will cause a fever will cure a fever;" a doctrine which appears, at first sight, hardly more reasonable than if one were to say, what will make a man drunk will make a man sober; or, what will break a man's leg will set it. Although, as is the case with any assumed general principle, a few specious facts may be quoted in support of it, or its truth may be admitted in a very limited number of instances, no one who reflects on the methods now, by universal consent, adopted in the treatment of the large and important classes of febrile and acute inflammatory disorders, can fail to perceive that a principle from which these and all surgical diseases must be excluded, has no claim to be looked upon as general. It can be no matter of surprise that a mind which can calmly entertain such a delusion, should believe that medicines daily used with the effects desired in using them would be more useful, nay, more energetic, if employed in doses a million, a trillion, or a decillion times more minute. Even of this extraordinary diminution of dose, and of its good effects, some examples may be adduced, which all must admit—that of mineral waters, for instance, although we are not sure that Hahnemann has availed himself of it. But, in this case, small doses are useful where larger doses of the ingredients of the water would be positively hurtful; and there is something, too, in the chemistry of nature not yet perfectly imitated by art. In many of the cases appealed to by the homoöpathist, (mercury, henbane, &c. being employed,) larger doses are given daily and with the best consequences, and in the same description of cases in which the followers of Hahnemann would divide a single dose into portions sufficiently numerous for all the patients in all the hospitals in the world. Still the narrow principle is again admitted, as universal, undeniable, and now first revealed to mankind. Precisely the same kind of reasoning pervades the homoöpathic doctrine of *chronic* diseases, *all* of which are ascribed to syphilitic taints or to some form of cutaneous disorder: thus adding another to a thousand previous instances, that in the circle of diseased actions any separate portion may be fixed on as the universal beginning by those whose defective sight is confined to that portion.

The reception of such doctrines, even by a few individuals, in any country where the reasoning powers are not utterly neglected, can but be regarded, to use an expression which the late Dr. James Gregory used to apply to such follies, as a pitiable proof of the ignorance and credulity of mankind. No one will think such censure unjustly applied to Homoöpathists, if he recollects, that without disputing concerning the examples which they bring to support their great principle of curing by resemblances, its absolute admission would dictate that ardent spirits should be given in phrenitis, in gastritis, and in cystitis[*]; opium in lethargy and coma; turpentine in irritable states of the urethra, and aloes in painful hemorrhoids; and that the only defence to be made against the accusation of merciless and even fatal practice in such cases, rests on the tenfold greater, although less dangerous, folly of giving the ardent spirits in doses of five hundred parts of a drop, and the turpentine and aloes in doses of the millionth part of a grain.

RELATIONS AND CONVERSIONS OF DISEASES.—Dismissing the subject of general theories of disease, it belongs to the general view of the laws which govern morbid actions, to notice the singular relations which exist between affections of different parts of the body, and also the conversions of diseases which are sometimes found to occur.

These may be viewed in connection with the vascular or the nervous system. The relation and conversion of diseases dependent on a state of plethora are so commonly observed as to be known to all practitioners. Such a condition not only disposes to all inflammatory disorders, but may induce the especial embarrassment of any single organ without inflammation; as, in the lungs, asthma or pulmonary apoplexy; in the brain, lethargy or cerebral apoplexy. Combined with a predisposition or susceptibility of the nervous system, it may concur to the production of gout or of mania.

As regards the relation of affections of the nervous system, we see whole families—every member exhibiting the family susceptibility, but each in a different manner, either from different portions of the nervous system in each being inadequate to healthy actions, or peculiarly affected by the circulating system. Eccentricity, excessive shyness or timidity leading to seclusion, chorea, epilepsy, amaurosis, mania, and other nervous affections, are very commonly observed thus associated by the bonds of relationship, giving as distinct a character to large families as the most peculiar external features of resemblance transmitted by inheritance.

New directions given to certain portions of the blood, together, probably, with a transference of morbid actions in the nerves, may cause not only the conversion of gout to mania, already mentioned, but of erysipelas of the scalp to phrenitis, or of erysipelas of the trunk to sub-inflammation of the intestinal coat with diarrhœa. The sudden repulsion of some of the disorders of the scalp in children, as of porrigo, is not unfrequently followed by meningitis. The sudden recession of the cutaneous efflorescence and inflammation in rubeola, scarlatina, or variola, is commonly followed by inflammation of the lungs, or the bowels, or the brain. The supervention of an affection of a new organ, or the subsidence of a similar disorder of an organ primarily affected, is usually termed *metastatis;* among the most familiar examples which may be mentioned, is that of rheumatism, in which the articular affection, when it suddenly ceases, is not unfrequently followed by inflammation of the pericardium, and even of the heart itself.

Irritations of the nervous system, of which the actual nature is very obscure, but the effects are very serious, may now and then be observed to succeed each other either by natural conversion, or in consequence of means employed for the cure of that which first existed. The most striking case of this kind which we ourselves have witnessed was that of a lady, who had been for several years affected with melancholia without any discoverable cause. When all the resources of ordinary means and medicine had been unavailingly exhausted, she was persuaded to try the prescriptions of an irregular practitioner. By his advice she persevered for some time in the use of the corrosive sublimate, together with large doses of the sulphuric acid. The mental depression gave way whilst she was taking these medicines, somewhat, as may be supposed, to the discomfiture of those who had vainly attempted to produce the same good effect. In a very short time the same patient began to complain of pain referred to the back and loins, of a burning character, at first occasional and not very severe, but which gradually became heightened to the extreme of human agony. Medical and surgical skill were fruitlessly exerted even to give temporary relief, and no means seemed for a moment to suspend the malady, or to give the faintest hope even that the principle of transition or conversion could be brought into operation for the patient's benefit. Her sufferings were unintermitting, except during short and broken intervals of sleep, for nearly two years: the lower extremities became powerless, then contracted, then inflamed by contact; and these complicated afflictions only ended in death.

The most singular transitions of nervous irritation are exhibited in hysteria, in the course of which the most severe inflammatory affections are sometimes simulated in succession.

The inconveniences following the removal or cure of chronic diseases are often such as to make the propriety of endeavouring to put an end to them somewhat doubtful. After the cure of a chronic diarrhœa by metallic astringents, we have noticed the re-appearance of scrofulous ulceration of the skin; and in a case in which this had occurred, and the ulceration was healed by a desperate quack, symptoms indicative of pulmonary tubercles immediately appeared, and death ensued. The same phenomena have often been known to follow measures calculated to repel enlargements of the cervical glands. We have many times observed the supervention of various inconveniences on the disappearance of chronic or habitual coughs. The cessation of gout, or the suspension of hemorrhoids, has often been followed by epilepsy or by asthma. These accidents, of which a long list might be given, prompt a very important indication to be observed in the treatment of all such affections, which will be dwelt upon in the article MEDICINE, PRACTICAL, PRINCIPLES OF.

Occasionally there is a translation of diseased exhalations or effusions. Anasarca will subside, and œdema of the lungs will follow. Hydrothorax or ascites are sometimes much relieved by dropsical swellings occurring in the extremities. General dropsy has come on after the cure of ephidrosis, both affections seeming frequently to be meant for the relief of plethora.

Some affections are suspended during pregnancy, apparently in consequence of a converted determination from the part disordered to the uterus. The instance of phthisis has frequently been observed; and we have noticed remarkable examples of it in obstinate and extensive psoriasis. It is curious that the determination to the mammæ during lactation does not prolong the benefit; a fact which common observation confirms as regards consumption, and which we have equally noticed in the example of cutaneous disease. The object of the law of nature here exemplified seems to be the preservation of the species, which after parturition may be vicariously performed.

MODIFICATION OF DISEASE BY TEMPERAMENT.—Other modifications of disease arise from what are called *temperaments*: they modify the predisposition to receive disease from the several *causes* which have been mentioned; and they modify the course of disease when it is excited by any cause. The term temperament, however, founded on an ancient doctrine of four humours supposed to temper each other, but long employed without reference to the theory in which it arose, and often with a vague and unsettled signification, is among the inconveniences of medical nomenclature, which so many have prided themselves on deforming by new additions of barbaric jargon, and so few have attempted to purify and improve. The *sanguine* temperament (indicative of the predominance of the sanguineous system), the *choleric* (or bilious), the *phlegmatic* (or pituitous), and the *melancholic* (or atrabilarious), are designations which, however frequently and familiarly employed, convey little precise meaning, and that little not always correct. The sanguine temperament is supposed to be characterized by a full habit, a soft skin, a ruddy complexion, red or auburn hair (the *flavus* of the Romans, and what the Scotch still call yellow-haired), a frequent pulse, large veins, and vivid sensations. The melancholic, on the contrary, is described as existing in a firmer frame, and thinner, with a dark skin, black hair, and a slow circulation: the nervous system is less easily moved; the disposition is grave and meditative (*meditabundus*, Gregory, in Conspect. cap. xxiii.), and the affections are fervent and steady. Intermediate between these is the choleric. But the phlegmatic differs from all in the laxity of the skin, the paleness of the face, the lighter colour of the hair, and the greater sluggishness of the faculties of the mind.

It is unquestionable that this ancient division must have been the product of extensive and delicate observation. It is even possible that when the varieties of men were less mixed, the temperaments, some of which continue the characteristics of nations, were less blended. At present, all attempts to limit the inexhaustible varieties of temperament, compounded, it may be, of so few and such simple elements, is as unsuccessful as to comprehend within the bounds of a few descriptions all the variety produced by the different associations of the few features of the human face. However interesting, therefore, a recollection of the temperaments may be to him who speculates on the varieties of human character, it now affords little help to the practitioner of medicine, and a consideration of their divisions may advantageously give place to one which has the recommendation of being at once more simple, not less comprehensive, and more easily admitting every diversity.

There is an evident difference in the susceptibility of different individuals to external and internal, to bodily and mental impressions; and this susceptibility, to the expression of which we would in medical language limit the word temperament, may be, and doubtless sometimes is, uniform throughout the whole individual frame of body and mind. But it is so often irregularly disturbed, and so often variously limited in different individuals, so liable also to transitory and permanent increase or diminution from various accidental causes, that it requires, for any useful pathological or therapeutic end, to be regarded with little or no reference to an arbitrary division admitting only of complete individual varieties. From the original or constitutional excess or defect of susceptibility to one or more, or all the impressions which the mental and bodily frame is intended to feel, arise various diseases, and the diseases affect, for the same reason, a particular course. The susceptibility may be so increased, that common light, common air, common sounds, common food, common occurrences, cannot be tolerated : it may be so diminished that these circumstances do not affect the senses on which they are intended to act. But the susceptibility may be partial; increased at one time, diminished at another—increased in one organ, and not in others; diminished in some organs, and in others increased.

To this kind of susceptibility the practitioner is required to pay much attention, in order to discover the tendency in his patients to particular forms of disease, and the consequent propriety of pursuing particular methods of cure. The occurrence of disease in any organ commonly, for a time, increases or diminishes its susceptibility to ordinary impressions. Thus, after fever, the brain and the intestinal canal occasionally remain for some time irritable and intolerant of all impressions, and in other cases for a long time inert and torpid. The disease of some organs induces or is connected with peculiar states of susceptibility in others. During the progress of tubercles in the lungs, the irritability of the heart is very conspicuous, and that of the bowels is not unfrequently fatal. In morbid states of the brain the stomach is sometimes irritable, and vomiting is a symptom ; and sometimes in a state so completely opposite that powerful emetics will not rouse it, and food is obstinately refused. In the same individual we may see the mind excited, or exhibiting, if we revert to the old terms, the peculiarities of the sanguine temperament, and the stomach, bowels, and skin decidedly phlegmatic; and to such cases no general term can correctly be applied. All these varieties of susceptibility undergo modification by climate, by diet, by excessive evacuations, by the neglect of exercise, by exclusion from pure air, by mistaken habits as regards clothing, and by other causes of which the importance is fully shown in the article Education, Physical, to which the reader is referred for many particulars which could not properly be here introduced. Modifications, both as respects the whole body and particular parts, are effected by age, and are noticed in the article under that head already referred to.

Generally speaking, there exists in women a greater degree of susceptibility to impressions than in men; and this is very often observed in that degree of excess which constitutes what Dr. Cullen called *mobility*, and which is the affliction of the greater number of those who are termed nervous patients. These are the individuals who feel all the impressions of sense with almost painful acuteness : they long retain, and vividly recal, the impressions of music and of painting, except when new objects excite them, and therefore longest in the dark ; and they are prone to hysterical affections, as various as the sensations and actions can be which may be associated with morbid conditions of all the various parts of the nervous system. (See Hysteria.) The importance of being acquainted with the modifications of disease in a temperament of this kind is very great indeed. Such patients are not only more readily affected by disease, but by remedies, than other patients. Soon reduced to apparent weakness, the same facility of being acted upon by various stimuli occasions their recoveries to be often equally sudden, and to the inexperienced practitioner surprising. Both the prognosis and the treatment must be regulated by these circumstances. Violent medicines will do the patient harm and him discredit. The pale, languid, feverish, irritable, complaining patient of to-day may before to-morrow be converted, by the unexpected visit of a friend, into a patient no longer submissive to physic, or mindful of slight ailments, but anxious to return to all the amusements of a dissipated life. In proportion as there is in the male sex an approach to this mutable susceptibility, the practitioner must expect the same results, and observe the same caution.

Vis medicatrix.—The signification and value of the different symptoms and signs of diseases are treated of in the articles Prognosis and Symptomatology. There is, however, one view of symptoms in general which especially belongs to the general subject of disease; namely, their frequent indication of that power in the system to which has been given the appellation of a *vis medicatrix naturæ*. This curative power or property, although the idea of it may have been pushed needlessly far, and rendered somewhat too material, is an undoubtedly existing property of the living animal body. It is this which Van Helmont personified as the archæus, or grand regulator, whose throne was the stomach. It is what Wepfer called the president of the nervous system : and we do not see that Stahl went beyond them when he referred the government of the body "directly and entirely to the rational soul," diffused, however, over the whole body.[*]

The truth is, that we have daily proofs of there being a power in the constitution to repair injuries and restore lost parts; and that several actions which we call disease are instituted to get rid of the causes producing them. Nor is there any necessary extravagance in the supposition that the possible intention of all may be so. The law may, perhaps, be said to be analogous with, or conformable to, the law of which natural philosophers have gained a knowledge by induction from various phenomena ; that all *action* is followed by *reaction*, equal to, but different from, the primary action.

If a bone is broken, if a muscle or tendon, or even a nerve is divided, the divided ends are reunited. If a portion of substance, as of the skin and cellular membrane and muscle, is lost, or cut out, the deficiency is repaired, and the cavity built up by granulations from the bottom, and at last covered in by new skin. If a part removed is without much delay re-applied — a tooth, the tip of the ear, a finger, a part of the nose—it becomes firmly united in its original situation. So anxious, if we may so speak, is nature to preserve the life she has given, that wounds of the most important organs will cicatrise; wounds of the lungs, of the heart, of the intestines, of the bladder, of the uterus, even of the brain.

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[*] See *Hoffman*, Commentarius de differentia inter Hoffmanni doctrinam medico-mechanicam et G. E. Stahlii medico-organicam.

Dr. Parry enumerates among salutary processes, re-action, shivering, convulsions, bodily exercise, tears, sighing, gout, dyspepsia, formicatio, vertigo, coruscations, fever, loss of appetite, and wasting. The propriety of including some of these may appear questionable; but illustrations of the salutary effects of the greater number will so readily present themselves to those familiar with pathological phenomena as to require no further observation. Many cases of conversion of disease are, of course, to be referred to the same head.* Viewing the principle in its widest extent, it may be said to be first exemplified in the convulsions of infancy; and it is exhibited for the last time, and ineffectually, in the convulsions so often preceding death.

There is a kind of consolation, not unattended with a hope of the final extension of medicine far beyond its present powers, to be derived from observing that even diseases of a most fatal character evince a conformity, as it were, to the same great curative and preservative law. The whole series of changes in the tubercle are but so many efforts to dislodge and eliminate it from the lungs; the process is attended with irritation, and by long continuance, or rather by constant repetition, it generally ends in death. A similar process prevails in cancer, and is sometimes, although rarely, more happily effected. Calculi in the bladder occasionally become enveloped in pouches of the lining membrane, and irritate the patient no more; and sometimes escape by ulceration into the rectum or vagina, or through the abdominal integuments.

There can be no difficulty in admitting these indications of the vis medicatrix naturæ, without referring them to anything more than an internal sense, which the preservation of existence did not require to be of the same nature as what are called the external senses. It would be hardly necessary to allude to the more material character given to this power, if the physicians who were most disposed to invest it with personal properties and dignity, had not, as a natural consequence, become too scrupulous about opposing it, even to the extent of curing all diseases by what the French have called *expectation*.

The proper advantage of acknowledging such a power is, that it prevents indiscriminate and officious meddling—that medicina *perturbatrix* which incessantly contradicts even the best efforts towards a natural cure. In the modern practice of medicine and surgery, the vis medicatrix naturæ is seldom disregarded; but its suggestions are not followed without discretion. Seeing the intention of its working, it is yet often seen by the practitioner to work in a dangerous manner, and too much by a general rule; sometimes too abruptly, and sometimes after too lingering a manner. The object of art is to adapt the rule to particular instances; and the greatest wisdom of the practitioner is shown in determining when to wait upon nature, when to rouse her to exertion, when to moderate those exertions, and when to put an absolute stop to them.

When a bone is broken, the body being previously in full health, the vis medicatrix naturæ is soon in full activity; the whole restorative force is called out. The vascularity, the heat, the vitality of the surrounding parts is increased; and inflammation ensues. But it is often necessary to moderate this zeal and haste of nature; to lessen the superfluous excitement, leaving only that degree of it without which the repair cannot proceed. Among savages the natural power of healing is so perfectly exercised, that it is said the most frightful wounds will heal without surgical aid. On the other hand, a patient of infirm constitution or disordered health becomes subject to some local congestion; or some accidental and trifling injury brings a part of the integuments into a state of chronic and inactive disease; and the vis medicatrix naturæ is not exerted until the obstacle to its exertion, the disordered state, perhaps, of the digestive organs, is removed by alterative medicines: but that done, and a wound or abrasion, which had remained stationary for weeks, instantly puts on a new character; secretory and absorbent processes are at once commenced, and the cure is soon completed.

We see, too, in the case of a patient alarmingly lowered by an attack of fever, the nervous energy sunk, the power of the heart diminished, the digestive function almost annihilated, the respiration laborious and feeble. Nature, unassisted, will undoubtedly try to make this patient rally: but if the trial is successful, it can only be so in the course of many weeks, perhaps many months; and the body and the mind will long continue to suffer, or perhaps never wholly recover. Often, after a succession of attempts, the patient sinks at last. But we know that by stimulants and tonics judiciously administered, we can rouse the powers of digestion, and re-animate the whole frame, in less than half the time and with less than half the danger.

Whilst, however, we seriously consider the design of nature in any malady,—whether she is working, and how she is working, and how the machinery will endure the process she has set up —we should still, having to treat diseases as they occur in civilized life, never trust entirely to the vis medicatrix naturæ, except in the case of the most trifling injuries, where a process of very small extent is all that is required for the cure.

The natural powers of healing and recovery are in many cases strongly influenced by peculiar mental states. The same emotions and passions which redden or blanch the cheek, which affect the cutaneous and renal functions, or those of the stomach and bowels, can also promote or retard the activity of the vis medicatrix naturæ. Confidence of recovery often conduces to recovery; and extreme despondency concerning the tendency of a disease sometimes leads to a fatal result. This is very conspicuous in some affections, as in fevers; and has often been asserted to prevail in malignant disorders, particularly in cancer: and some practitioners are consequently inclined to place implicit reliance on the prognostics in which their patients are disposed to indulge. But the example of phthisis, which is in that respect not singular among chronic disorders, may serve to show that confidence may be even a part of the disease, arising from a morbid condition of the sensorium: and we have attended patients in lingering forms of fever, which ended happily, yet throughout the whole course of which it was impossible to excite a ray of hope in the mind of the patient. In some cases the cessation of the fever induces a deep but temporary despondency of recovery. Even with these exceptions, the influence of the mind over disease should never be overlooked by the practitioner; nor should he forget to inculcate that this influence of the mind, like all the mental actions, may by firm endeavours be to a great extent subjected to the will.

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* See *Parry*, Elements of Pathology and Therapeutics, vol. i. Par. DCCCLIII to DCCCLXVI. Second edition, 1825.

Acute and Chronic Diseases.—The different period required by different disorders, unassisted by medicine, for the production of a natural cure, or, in fatal cases, for the destruction of life, has long been the occasion of a general division of diseases into *acute* and *chronic*. Acute diseases are commonly attended with severe and obvious symptoms; whilst chronic disorders are usually less marked, and attended with less suffering. To these distinctions there are, however, exceptions. Diseases of short duration, and in their effects destructive, are sometimes attended with few symptoms of the mischief they are effecting in the brain, in the lungs, or in the intestines; and diseases slow in their progress are often accompanied with sufferings of a very severe kind.

In acute disorders there is, except in rare instances, warning sufficient to guide the practitioner; but in chronic diseases the most extensive injury sometimes proceeds undiscovered until the discovery is useless. Acute inflammation, for instance, can seldom be overlooked; but chronic inflammation is frequently unnoticed until some of its worst effects on structure have been wrought by long continuance. It is no less essential to the physicians than to the surgeon to be especially mindful, in all obstinate maladies, of the possibility of serious disorder.

Periodicity and Crises of Disease.—But there are also diseases, acute as regards their severity, and chronic as regards their duration, which are what is called *remittent* and *intermittent*. The symptoms arise and decline in a certain series and in a certain time; then disappear, and after a certain interval are renewed. The class of fevers remarkably exhibits all the peculiarities of remission and intermission; and these will be described under the head of Fever. In this general view it may be sufficient to mention, that in our common continued fevers there is generally once, and sometimes twice, in the space of twenty-four hours, an observable remission or marked alleviation of the febrile symptoms. It is, however, in many cases not very striking; and it is always less striking in this country than in those fevers of warmer climates to which the observers have agreed to give the name of remittents. In one class of fevers, sufficiently familiar to the practioners of marshy countries, the remission is so marked and of such continuance as to be denominated an *intermission*. Each paroxysm of an intermitting fever or ague has a precise beginning, middle, and end, with an unquestionable cessation for a time, after which a new paroxysm is commenced. The intermission is never of less length than some hours; it is often twenty-four, and not unfrequently forty-eight.

Not, however, in fevers alone have these well-known but unexplained circumstances of intermission and remission been observed; diurnal remissions are distinguishable in every attack of inflammation. There are periods of the day or night in which the symptoms are less severe, and other periods in which there is an exacerbation. Even some inflammatory affections are intermittent, of which, perhaps, rheumatism is the most frequent example; although pleuritic and other inflammations have been described as assuming the same character.

An intermittent form of attack may very commonly be observed in many of the disorders usually called nervous or spasmodic; as in hysteria, epilepsy, and nervous asthma. Close observation will occasionally detect regularity in the attacks of epilepsy, where slight inquiry would not cause it to be suspected. We have sometimes found the alternate fits corresponding in point of time, and the paroxysms very nearly observing two distinct periods; so as to be somewhat analogous, only with much longer intermissions, to what is called a double tertian. The same intermission, more or less regular, and often with considerable intervals, prevails in a great number of cases of maniacal affection.

The intermissions in these instances appear sometimes to be associated with periodical changes, not appreciable except in their effects, in the nervous system itself. At other times there is a manifest periodical excitement of the vascular system; but whether a primary excitement or not, the progress of physiological and pathological knowledge will alone discover. The ancient cultivators of medicine attached considerable importance to the periodicity of inflammatory affections, even of the slightest kind; believing that whatever measures were employed, they would run a certain course, mitigated perhaps, but not prematurely brought to a termination. Both with respect to these and to the febrile disorders, certain days were believed more favourable to a termination of the malady than others, or even to its amelioration. These were called *critical* days. If the disorder did not begin to decline, or altogether decline, on one of those days, the hope of the practitioner was transferred to a future critical day, overleaping one or two days, and sometimes a greater number. Unfavourable changes were alleged to occur on the same days in bad cases. For a belief sanctioned by the acute observation of the Greeks, and more or less cherished by almost every sect up to the present day, it must at least be said that there must be some strong foundation. Yet on few points are modern authorities more at variance; some retaining the old faith pure and unmixed; some admitting it with reservations; and some regarding it as a venerable but a groundless prejudice. We are not afraid to confess that our individual observation inclines us to rank among the believers; although at the same time we acknowledge the insufficiency of individual observation on a question of this nature.

There is some analogy between these periodic movements of disease, and the periodical performance of certain of the healthy functions, although, as regards several of the latter. the effect is commonly ascribed to habit. The desire for food, however, and that for sleep, which may be looked upon as indications of an approach to a state of exhaustion in some part of the system, are found to recur within a certain period in all; whilst in the instance of the uterine functions in the female, and in the frequent examples of inconveniences resulting from a plethoric state of the blood-vessels, there is a certain effect produced within a given and exact time, and with which habit can have nothing to do. Again, in almost all slight but not very transient disorders, there is an alternation of excitement and depression, "a good day and a bad day;" and, during convalescence, particularly from fever, we have often noticed the great distinctness of this intermittent or periodical character.

As from the earliest cultivation of medicine it was observed that some peculiar circumstance or state of the body accompanied the solution of many diseases, or preceded and, as it were, announced their favourable issue, or, on the other hand, their termination in death; these circumstances or states came to be spoken of as constituting what was called a *crisis*, (from κρίσις, judgment,) and the days on which they were most generally found to take place were termed *critical days*. This language still prevails, even among those who are less inclined than ourselves to credit the ordinary restriction of such occurrences to distinct periods.

Certain changes, often noticed as preceding death, more especially in chronic diseases,—hiccup for instance,—and which are therefore considered and called critical, do also, if any faith may be reposed in popular observation, sometimes recur, increase, or alternate with other critical changes, at periods answering to that when the first warning of that kind appeared. If physicians place no reliance on such testimony, we are inclined partly to attribute it to their being seldom long engaged in watching maladies at the bed-side, where the senses and thoughts naturally become concentrated on the events of the sick chamber alone. Our own observation in the course of country practice, and in cases where circumstances have occasioned our attendance to be close and protracted, has, we must candidly own, gone some way to corroborate the popular evidence on these points, which are certainly not of a nature to be made familiar to those whose chief knowledge of disease is acquired in formal consultations, or in daily visits to the wards of public institutions. No harm can arise, at all events, from directing the practitioner's attention to a subject which can only be investigated by a close attention to all the phenomena of ordinary sickness.

In the progress of a fever, the recovery or the fatal termination is doubtless often preceded by some new action exemplified in the state of the bowels or of the skin. The sweating stage of an intermittent will occur to every reader as an example; but analogous phenomena often characterise those fevers which are denominated continued. Some are also distinguished by critical eruptions, of which the appearance relieves the febrile state. Certain conditions of the cutaneous or respiratory functions, productive of a peculiar odour of the breath or perspiration, are well known to practitioners as indicative of an aggravated malady.

Inflammatory disorders sometimes suddenly and happily terminate on the supervention of catharsis; whilst the common termination of inflammation in abscess is itself often spoken of as critical; so that to this day we hear of crude abscesses, of the digestion of the pus, and, among the older members of the profession, of the coction of the matter. Nervous affections, dependent probably in such cases on a plethoric state of portions of the nervous system, often for a time disappear immediately after an attack of epistaxis, or, in females, on the appearance of the catamenia after suppression. The accession and the departure of a paroxysm of hysteria or of asthma is sometimes marked by a copious flow of limpid urine; and a very free excretion of mucus from the bronchial membrane forms the common and true crisis of the asthmatic fit. Countless illustrations might be accumulated, but no one conversant with disease can have failed to remark them.

According to doctrines now very little regarded, these and numerous other phenomena acquired an additional importance from being considered indicative of the successful or unsuccessful results of a supposed struggle in the system for the expulsion of a morbific matter; a supposition which, in many cases, is so far from being in any degree unphilosophical, that it rests on facts too plain and of too frequent occurrence to admit of the least dispute. The terms crudity, digestion, and coction, have however been conveniently laid aside, as communicative of a sense which was not sufficiently exact.

The days on which the critical events are to be expected, have been variously named by different observers. This discrepancy, and, indeed, the chief difficulty in ascertaining, by actual observation at the bed-side, the truth or incorrectness of the ancient belief, arise from the same cause, namely, the uncertainty so often existing respecting the day on which any given disease actually commenced. In fevers, the first day is sometimes sufficiently marked, but not uncommonly it is impossible to determine when the general disorder was really advanced to the febrile condition. We should ourselves venture to direct the attention of those anxious to investigate this curious subject, to the third, fifth, seventh, eleventh, fourteenth, and twentieth days of our common fevers; and we think their attention will not go quite unrewarded.

The physician will, perhaps, find that in a considerable proportion of cases of continued fever, his services are first deemed necessary on the third day of fever, in consequence of symptoms indicative of a serious disorder then first becoming observable to the friends of the patient. Judicious treatment will often assist in bringing about a favourable change on the fifth or seventh; or a decided improvement will occur between the eleventh and the fourteenth day; or be postponed until about the twentieth. Without affecting rigid exactness in respect to these days, or attaching extravagant importance to them, we have certainly thought ourselves justified in these conclusions respecting them, by observations made in circumstances not unfavourable to precise and undisturbed observation. The principle assumed is one which in numerous cases of disease is perfectly undeniable—that certain morbid processes are for the most part effected in definite periods of time.

It is not the object of the present work to collect the curiosities of medical literature; and we have therefore briefly dismissed this, among other subjects, on which it would be easy to prolong ingenious discussion. The practical application of the doctrine of a crisis is obvious. Its observation may conduce to exact prognosis; an art so difficult and deceptious, that all prudent physicians advise that the prognostic should be guarded with a care that may, in all cases, cause it "to quadrate with the event;" but at the same time an art in which the observant practitioner wonderfully excels those whose notice of the turns and changes of maladies is less diligent. Moreover, if a disease ordinarily terminates in some specific way, or in some specific crisis, the induction of that particular crisis becomes a wise indication for the guidance of the practitioner, although it will often be found that art cannot accomplish more than an ineffectual imitation of those critical evolutions which nature wants the power to perform.

Besides the property inherent in the body which may be assumed in many instances of periodicity to be the primary cause, there is an evident periodical influence exerted over many maladies by certain combinations of temperature, moisture, electricity, and other atmospherical properties, at different seasons of the year. There are individuals who in the spring of each year become maniacal; others in whom the heat of the summer seems to produce the same unhappy effect, and who are well in the winter. A tendency to vernal fever is very common in delicate women; and an aggravated dyspepsia, arising from gastric and intestinal irritation, is the frequent precursor, and apparently the exciting cause of many of the fevers of autumn, which are so commonly termed bilious; and with which some individuals are regularly attacked every year.

The influence of the heavenly bodies on the corporeal actions of the beings inhabiting this planet, the *lunar* and *sol-lunar* influences, once so reverently regarded, have been for some time past so often the subject of ridicule, as to make almost any allusion to them liable to the same reception. It would, however, be difficult to show, in the first place, any very good reason why animal bodies should be exempted from the operation of masses capable of acting on large portions, or on the whole of the globe on which they live; and abundant testimony, although not always, it must be confessed, very conclusive, might be collected in favour of views which have been too entirely discarded. That a lunatic should be under lunar influences, is an opinion now seldom mentioned but to afford an opportunity for complacently contrasting the wisdom of the present time with the credulity of the past. Yet of those who have the charge of lunatics we have, we think, found the majority disposed to believe as their forefathers did. The determination of all questions of this kind requires such long and patient observation; there are so many collateral sources of deception, and the exceptions appear to be so frequent; that it is to be feared mankind will long continue to content themselves with unweighed assertions on the one hand, and indolent and contemptuous incredulity on the other.

NOSOLOGY.—It was our intention to conclude this article with a view of the different *arrangements* of diseases which had been made by successive physicians since Aræteus first divided them into acute and chronic, unless, as is sometimes stated, Asclepiades is to be considered as having been the first deviser of nosology, many of his definitions being retained by Cælius Aurelianus. Galen, however, mentions Mnesitheus, who lived after Hippocrates, as having distinguished himself by the classification of maladies.

Conceding that the use of all nosological studies is really limited to the schools, and that to the practitioner they afford no immediate aid, it is yet not uninteresting to see the way in which some of the greatest men who have ever cultivated physic have attempted to reduce the innumerable diversities of disease into something like order. Not to dwell on their divisions into those of the solids and fluids; into internal and external; into idiopathic and sympathetic; into protopathic and deuteropathic; into hereditary, congenital, and acquired; into those of infancy, childhood, adult, and old age; into those attacking men and women; into the salutary, the benign, the malignant, and the pernicious: and without insisting vehemently on the importance of the divisions into curable, incurable, and fatal; or, with regard to the seasons, into the vernal, those of summer, the autumnal, and those of winter; or into the sporadic and popular; or into febrile and non-febrile; or sthenic, or asthenic; or general and local: and passing over many other refinements of a like kind, too often based on erroneous theories;—it would be most unjust to forget the eminent services of Sauvages, the first of the modern nosologists, (1731,) and the frequent references to whose writings in this work sufficiently show the estimation in which he is yet held. The celebrated Linnæus also, in 1763, endeavoured to arrange diseases with the same regularity with which he classed the objects of botany, but with less success. Among the classes of Sauvages were anhelations, weakness, pains, and discharges, all of which are usually but the *effects* of disease. In the arrangement of Linnæus, fevers and syphilis are placed together, on the ground that both are contagious.

In the more complete attempt of Dr. Cullen, praised,' and justly praised, as an estimable work by his successor, Dr. Gregory, catarrh and dysentery are placed together, because both are profluvia, or discharges. Dr. Cullen's nosological arrangement was succeeded by that of M. Pinel, which became as general in the French schools as that of Cullen had been in England. The arrangements of Sagar, Macbride, Bang, Daniel, J. P. Frank, Sprengel, Hufeland, and many others, in whatever estimation they were once held, or whatever merit they possess, are now seldom referred to except by the curious. Even Cullen's nosology is almost unknown in the schools of London; and Swediaur, who tried to improve it, is no better remembered. Among the nosologists who have pushed the science to extremes, Vitet is sometimes alluded to, as placing in his sixth class, or diseases of *evacuation*, and in its fourth order, *of organised bodies*, accouchement, avortement—making pregnancy a disease, "beginning in conception, and ending in delivery."

The name of the celebrated John Brown demands, at least, a passing attention. Dividing all disorders into sthenic and asthenic, he established on that bold foundation a superstructure of physic so ingenious, that, great as its defects were, and great the practical errors into which they led, they long attracted the regards and admiration of many of the most famous schools of Europe.

With more attention to the natural phenomena of the human body, with more practical experience and wisdom, but at the same time with a freer indulgence of fancy, Darwin attempted a new arrangement of diseases in the Zoonomia; a work in which, amidst a great variety of matter of very various value, the student will find many practical observations indicative of the penetration and genius of its distinguished author.

Dr. Bartholomew Parr, the author of the London Medical Dictionary, a work of great merit, and full of practical information, attempted to improve the nosology of Cullen, but little was gained by the attempt. Inflammations constitute his second class, and in it we find phthisis. In the profluvia we meet with cholera and diabetes. In the suppressorii, or suppressed functions, we find constipation, and asthma, and jaundice, and thirst.

These obvious inconveniences of artificial classification, which so many able persons have been so little able to avoid, show in an unanswerable manner the inutility of such divisions. If we were disposed to ridicule the science of nosology altogether, we might dwell on the nosology of Dr. Parkinson, who divided all diseases into hyperbiosis and catobiosis, and hoped "to obliterate the term fever from nosological language;" or we might turn to the *chemical* nosology of M. Baumes, of Montpellier, who classified maladies as calorinised, oxygenised, hydrogenised, azotinised, and phosphorenised. But any further consideration of the subject would be of little use to readers of any class.

If any arrangement is likely to be useful in a practical point of view, it would seem to be either that of diseases according to the *parts*, or the *functions* which they respectively most affect. The former is the arrangement followed by the present professor of the practice of physic in the London University; and the latter was followed by the writer of this article in the same chair. By observing either of these methods, the student's practical knowledge seems most likely to become conveniently and usefully arranged, so as to be retained with the greatest certainty, and referred to with the greatest facility; the first inquiry of a practitioner who is investigating the case of a patient, being concerning the part or function affected. Some affections, as fever, being of a general character, are conveniently placed in a distinct class. The specious exactness of an arrangement proposed by Dr. Young, the learned author of the Introduction to Medical Literature, never sufficed to bring into general notice a system which was seen, at the first glance, to be without any practical utility; and the same general objection may well excuse our dwelling upon or detailing any particular system in a work like the present. The functional arrangement adopted by Dr. Mason Good might deserve particular notice, on account of the reputation of its author, were it not that his incredible prodigality of barbarous medical terms has made his nosological arrangement, if not quite confused and unintelligible, at least such as to defy the efforts of the strongest and most retentive memory. Having ourselves attempted a plan much less ambitious, and, as we believe, much more useful, it affords us no small gratification to find that the principle of that which is followed by a teacher of so high and deserved a reputation as Dr. Elliotson, is as nearly as possible the same. The only object of any consequence which it was ever pretended that nosology could effect, is the accurate discrimination of diseases. This cannot be taught by short definitions, but by full, and careful, and collated descriptions: and in order that such descriptions may be readily made and remembered, we believe that arrangement of diseases to be the best which causes those which affect the same organ to be brought close together. Their resemblances may thus be best compared, and their differences best observed; of which the result will be, that facility and accuracy of diagnosis which so greatly contribute to distinguish one practitioner from another; and, indeed, without which, no man, be his learning or his science what they may, can ever practise physic with success or satisfaction.

J. Conolly.

[DISINFECTANT; from *dis* and *infect*. This term has been restricted by some writers (Dr. A. T. Thomson, *Elements of Materia Medica and Therapeutics*, 2d edit. Lond. 1835) to those agents that are capable of neutralizing morbific effluvia. It is so employed by the author of the article Disinfection, in this work. The writer has always used it, however, to include antiseptics. These will be considered here;—the reader being referred to the next article for information in regard to the others.

Antiseptics, as the writer has defined them elsewhere (*General Therapeutics and Materia Medica*, ii. 373, Philad: 1843), are "Substances that are capable of removing any incipient or fully formed septic condition of the living body, or of any part of it." If we grant, that such a septic tendency may exist in the organism, under particular circumstances, we can conceive that antiseptics may be needed in two contingencies: *first*, to obviate such tendency, and *secondly*, to correct the offensive character of any of the tissues or secretions that may have become putrid, and thus prevent them from re-acting on the system. Generally, the acceptation of antiseptics includes only agents that are employed when signs of putrescency have already manifested themselves, and when the object is both to destroy the offensive character of the tissues or secretions, and to arouse the vital energies, so as to enable the functions of nutrition to take fresh activity, and throw off the morbid and morbific degeneration. With this view, the different vegetable tonics, and especially cinchona, with the mineral acids, are commonly exhibited, in order to induce a new action in the function of innervation,—and, through the improved hæmatosis, to enrich the vital fluid, so that, when it reaches the capillaries,—under the amelioration occasioned by these combined changes,—the organs of nutrition may assume fresh activity; and if a portion of the organism has become dead, and consequently extraneous, a separation of the dead from the living portions may be more readily accomplished. In this way, probably, most internal antiseptics act; whilst, by passing into the mass of blood, and being exhaled through the different emunctories, they may, at the same time, correct any septic condition or tendency which the different tissues or fluids have acquired. The action of some antiseptics cannot, however, be explained in this manner. This can obviously only be the *modus operandi* of such as enter the blood-vessels,—wholly or in part. Charcoal probably exerts its efficacy altogether on the first passages, and, through them, on the rest of the economy. It is difficult to conceive, that it can act through the medium of the circulation; whilst the chlorinated preparations, creasote, &c., produce their effect in the compound mode above described. In like manner, when these and other agents are applied externally to gangrenous or gangrenoid parts, their operation is equally complex. They first of all disinfect, by acting chemically on the parts with which they come in contact, and, as a general rule, stimulate the vital energies of the tissues, until these assume a new action, and throw off the morbid condition and degeneration. With this view, antiseptics are employed in gangrene, sphacelus, foul ulcers, &c. Some of them would seem to act merely as disinfectants: such is probably the case with charcoal; it merely destroys the putrid emanations, and thus prevents them from acting injuriously on the system.

Of the special disinfectants of the living body, the most important are the following:

Sulphate of Alumina.—The power, possessed by the aluminous salts, of preserving animal matter has only been appreciated of late years, and chiefly through the labours of M. Gannal; (*History of Embalming*, &c. translated by Dr. Harlan: Philad. 1840.) M. Gannal prefers the simple sulphate of alumina, made by the direct combination of alumina and sulphuric acid. It has been chiefly to prevent putrefaction in the dead body, that the salts of alumina have been employed. They have, however, at the writer's suggestion, been used in the Philadelphia Hospital as antiseptics and detergents to foul, indolent ulcers, and with decided benefit; (*New Remedies*, 4th edit. p. 56: Philad. 1843, and *Medical Examiner*: Philad. 1843.)

Chlorine, in vapour, has been inhaled in gangrene of the lungs, in which it has been found to correct the fetor of the breath and expectoration, and to be, therefore, calculated to obviate not only the local but the constitutional symptoms. (Stokes, *Dublin Hospital Reports*, vol. 5.)

The aqua chlorini has been given in various cases as an antiseptic—as in typhus, scarlatina maligna, cancrum oris, gangrene of the lungs, &c. It has also been used, properly diluted, as a wash to foul ulcers—as a gargle in putrid sore throat, &c.

Chlorinated Lime and *Chlorinated Soda* have been used in like cases.

The *Muriatic Acid* and *Empyreumatic Acetic* or *Pyroligneous Acid* have also been prescribed, both internally and externally, as antiseptics. The latter owes its main properties to the *creasote* which it contains. This last is rarely given internally: it is sometimes applied to foul, indolent ulcers, to prevent or correct the putrefaction of secreted matters, and to stimulate the parts to a better action. It is also used as a wash in gangrenous stomatitis; and as a collutory, when a fetid breath originates in the decomposition of matters in the mouth.

Charcoal is occasionally given internally, in septic conditions; but it is most frequently applied topically, as in dentifrices, and foul ulcers. All the different *tonics*, too, have been prescribed internally, as well as applied externally, in similar conditions. A poultice of powdered *cinchona* is a common application to foul ulcers, and to gangrenous parts; and a decoction of cinchona, with muriatic acid, is frequently used as a gargle in ulcerated sore throat.

ROBLEY DUNGLISON.]

DISINFECTION.—This word, being in some degree new to our language, is here used to express the operations by which we attempt to clear the air and other bodies from the contamination of certain minute particles, some perceivable by the sense of smell, others not to be thus recognised, but all producing deleterious effects on the human system. Of those perceptible to the sense of smell the chemical qualities are in general more or less known to us; of those too, which are not to be thus perceived, we possess some chemical knowledge; but of others we know nothing excepting their deleterious effects on the human system, and occasionally on that of inferior animals. (See INFECTION.)

However various the sources of contamination, the means which have been resorted to for their correction are reducible to three heads: first, diluting, with pure air, the atmosphere of the infected apartment or place; secondly, the admixture of certain gaseous matters with such an atmosphere, in order to decompose the infecting particles: or attempting to divest the atmosphere of them by substances which have an absorbing power; thirdly, clearing, by washing, cleansing, and exposure to the air and to disinfecting agents, the solid matters, such as bed and body clothes, the walls of apartments, &c., of the noxious matters with which they might infect the atmosphere by slowly giving them out to it.

1. Diluting with pure air (for the means of accomplishing which see VENTILATION) is the

measure which, in all cases admitting of correction, merits the most confidence, and without which all other means are nugatory. It is the sole proceeding resorted to in cases in which the atmosphere of any place is rendered deleterious to life by the admixture of considerable quantities of noxious gases, as of carbonic acid produced by vinous fermentation, the combustion of charcoal, or the decomposition of vegetable matters in a close place; or of carburetted hydrogen, which is occasionally so copiously evolved in coal-mines; or where the wholesomeness of the air is impaired simply by the destruction of its oxygen, as occurs in the acid fermentation; or where great numbers of persons are assembled in a place comparatively small.

2. The decomposition of the infecting particles has been attempted from an early period. Large fires were formerly kindled in the streets of a town where pestilence was prevailing, with this view; but it seems more than questionable whether they can in such a situation produce any beneficial effect whatever, and by enlightened people they are now entirely abandoned. In a limited quantity of air, however, as in an apartment, or the hold of a vessel, they may be useful, not by acting chemically on miasmata, but as a ventilating process, by causing a current of air in such situations; the heated and consequently light air ascending through the chimney or any aperture which may exist, and being replaced by a portion of that from the exterior. The firing of gunpowder in the open air, which has been occasionally resorted to, seems destitute of any effect, for we cannot expect any beneficial chemical action from the azote, carbonic acid, sulphate and sulphuret of potash, which are its products; neither can there be hoped from it any movement of the atmosphere sufficiently general to be of service; but in a limited space, by expanding the air, it may certainly cause it to be replaced by a portion of the cooler and more condensed external air. Fumigations with certain aromatic substances, as camphor, benzoin, &c., have enjoyed a degree of reputation probably unmerited, and founded solely on their property of disguising unpleasant odours; but they are now superseded by measures deemed more scientific, which we shall proceed to consider.

Quick-lime.— This substance, besides its well-known property of absorbing carbonic acid, which is copiously evolved from putrefying masses, appears, too, to absorb other gases which are the result of putrefaction; at least it has the quality of correcting offensive odours. From its power in this way, and probably from a supposition that it decomposes or absorbs miasmata, it is usual to pour it into privies or drains which emit offensive odours; and when pestilential diseases are prevailing to an extent to cause great mortality, it is customary to throw a thick bed of this substance over the corpses in the grave or trench in which they may be deposited. It is applied, too, in the form of whitewash to the walls of apartments, in which persons ill of febrile disorders have lain, as a security against any contagious matter which may have adhered to them.

Charcoal.—This substance, as is well known to chemists, possesses the property of absorbing gases, and might, on this account, be advantageously employed to rid a limited portion of air of hydrogen or other offensive matters with which it is impregnated. It has not, however, been employed in this way; but the utility of charcoal filters in divesting water of any gases, the products of animal or vegetable decomposition, with which it is contaminated, has long been recognised.

Acids.— These have long been supposed to have the power of decomposing contagious matter, or in some mode depriving it of its virulence. The well-known *thieves' vinegar* owed its popularity to this supposed property; and it is still the custom to dip into vinegar letters and papers which arrive from places where pestilence is prevailing. Clothes and goods of all kinds, coming from lazarettos, are exposed to the vapours produced by the slow combustion of sulphur (sulphurous acid). But the former being thought too feeble, and the latter having been found exceedingly irritating to the lungs, they are rarely employed for general disinfecting purposes; and when acids are used, either the muriatic, the oxymuriatic (chlorine), or the nitrous is resorted to, though the employment of any of them in an inhabited apartment is not unattended with serious inconvenience to patients and attendants.

Muriatic acid was first employed by Guyton Morveau, in 1773, to disinfect the principal church of Dijon, the air of which had become so contaminated by the emanations from the vaults below, from which, on account of their too crowded state, the bodies had been removed, that it was utterly unfit for divine worship. Vinegar, aromatics, and the deflagration of nitre had been tried without effect; but the vapour arising from the decomposition of six pounds of common salt by two of concentrated sulphuric acid deprived the air in one day of all unpleasant odour, and in four days afterwards worship was performed. This distinguished philosopher, towards the close of the same year, used fumigations of muriatic acid with complete success for disinfecting the prison of Dijon, whither fever had been imported from other gaols, of so malignant a nature that thirty-one prisoners had perished from it in a very short space of time.

The proportions recommended are twelve parts of sulphuric acid of the specific gravity 17· to fifteen parts of muriate of soda, which should be slightly moistened before the acid is poured upon it. If employed for disinfecting an uninhabited place, flat earthen dishes, containing the mixture, may be placed on a sand-bath, and the whole of the acid may be added at once. If in one occupied by patients or others, all heat should be dispensed with, and the acid should be added gradually. The latter rules should be considered imperative in all cases where acids are employed to disinfect inhabited places.

Nitrous acid fumigations were first employed in this country; and a liberal parliamentary grant was bestowed on Dr. Carmichael Smyth for their application to disinfecting purposes, which was regarded as a discovery. A prior claim was subsequently set up for Dr. Johnstone, of Worcester. The fumigations were successfully employed by Dr. Smyth in 1780, for checking the progress of a fever which prevailed among the Spanish prisoners at Winchester, of whom it had destroyed a seventh part in three months. Several other examples of their utility in disinfecting ships and hospitals might readily be quoted. Nitre and sulphuric acid are the substances employed in this mode of fumigation, and equal parts of both ingredients are found to be the best proportions. The combination of the salts producing a considerable evolution of heat, none should be employed to aid the decomposition. It is calculated that half an ounce of each ingredient will suffice to disinfect an apartment of ten feet in each dimension, comprising of course a thousand cubic feet; and it is advised, in case of our having to apply the method to larger apartments, that we should multiply the cups or saucers which contain the ingredients, rather than introduce a larger quantity than that mentioned into one vessel, as the red fumes disengaged might seriously incommode the operator.

Oxygenated muriatic acid (chlorine) was first proposed as a disinfecting agent by Fourcroy, in 1791. It was soon after employed by Cruickshank, of Woolwich, and by Guyton Morveau, who thought it preferable to all other acids; and it has since united most suffrages in its favour. There is an excellent and concise account, in the eighteenth volume of the Journal of Science and the Arts, of the disinfection of the Milbank Penitentiary by Mr. Faraday. To this the reader is referred, as it comprises all that is necessary to be known of the mode of applying fumigations of chlorine to uninhabited places. The following are the material points of the process adopted by Mr. Faraday. He found that one part by weight of common salt, and one part of oxyde of manganese, when acted upon by two parts of oil of vitriol, previously mixed with one part by weight of water, produced the best results. The salt was bruised down with a mallet previously to being mixed with the manganese; and the acid and water were mixed in a wooden tub, and allowed to stand for some hours, that the heat produced by their combination might be dissipated before they were poured on the other ingredients. Common red pans, of a flat form, were used for the fumigation. The evolution of chlorine commenced a few minutes after the ingredients were mixed in the pan, and continued for four days, no extraneous heat being employed in the operation. The quantity of material used was 700lb. of salt, 700lb. of oxyde of manganese, and 1400lb. of sulphuric acid; whilst the space requiring fumigation amounted to nearly 2,000,000 cubic feet, and the surface of the walls, floors, and ceilings was about 1,200,000 square feet. The able arranger of the process is of opinion that from one-half to one-fourth of the chlorine, and consequently of the ingredients employed for its production, would be quite sufficient in a building of the same extent, for any of the usual cases where fumigation is required. The proportions recommended by Guyton Morveau differ from those employed by Mr. Faraday. The former philosopher advised that two parts of powdered oxyde of manganese should be mixed with ten parts of muriate of soda, and that the mixture should be acted upon by six parts of sulphuric acid previously diluted with four of water; and in an uninhabited room, forty feet by twenty, he thought two ounces of oxyde of manganese, ten ounces of muriate of soda, six ounces of sulphuric acid, and four ounces of water, sufficient for perfect disinfection; the doors and windows being closed for ten or twelve hours.

Chlorine is so powerful an irritant to the bronchial lining, that its rapid evolution in the processes described above is quite inapplicable to inhabited apartments or wards, unless the quantities of the ingredients employed are so small in proportion to the space to be disinfected that we cannot expect any beneficial result from them. Guyton Morveau endeavoured to surmount this difficulty by means of his permanent apparatus of disinfection, which consisted of a glass vessel encased in wood, having its mouth very accurately closed by means of a ground glass stopper, acted on by a vice. A slight turn of the vice allowed the vapours, by their expansive force, to raise the stopper and mingle with the atmosphere. One-third of the apparatus was occupied by four parts of oxyde of manganese, finely powdered and sifted, ten parts of nitric acid of sp. gr. 1.40, and ten of muriatic acid of sp. gr. 1.134. From this combination the chlorine is disengaged much more slowly than by the action of sulphuric acid on a mixture of muriate of soda and manganese; and by means of the vice the issues of gas are regulated at pleasure, whilst the lightness and closeness of the apparatus enable us to remove it readily from one place to another. The disinfecting bottle, arranged in the manner described, may be opened twice a day, and still retain its disinfecting power for three or four months. However ingenious the plan of M. Guyton Morveau, this, and perhaps all disinfecting processes—certainly all for occupied wards or apartments—are superseded by the agents more recently introduced by M. Labarraque. This gentleman, an apothecary in Paris, was the first to suggest the employment of chlorine in a liquid form for disinfecting purposes. He recommends two solutions. One, the chloride of lime (a solution of bleaching powder,) is prepared by passing chlorine gas over hydrate of lime: this, when dissolved in water, forms Labarraque's liquid; or the liquid may be formed directly by passing the gas into water which holds lime in suspension. Two methods are recommended for forming chloride of soda, one by M. Labarraque, and the other by M. Payen. The former passes chlorine gas into a solution of carbonate of soda; the latter decomposes chloride of lime by the carbonate. Both processes are easy, the latter the most so; and it has been so arranged by M. Payen as to make the resulting compound identical with that prepared by the former method. No carbonic acid is expelled on passing the chlorine into the solution of carbonate of soda; the solution has a faint smell of chlorine; when heated, scarcely any chlorine is evolved; it first acts as an alkali on turmeric paper, and then bleaches it; on the addition of acid, chlorine and carbonic acid are expelled.

Chemists do not seem fully agreed as to the precise nature of these compounds, but in a practical work we do not feel called upon to enter into controversies on this point. (See Granville in Journal of Science, &c. vol. xxiii. and R. Phillips in Philosophical Magazine, vol. i. of New Series.)

It is material to know that they are most powerful disinfecting agents, and that since their introduction by Labarraque they have been applied to every kind of case in which the operation of such agents is requisite, by innumerable scientific persons of various nations, whose testimony is loud in their favour. They appear to act, as the experiments of Gaultier de Claubry tend to prove, by the evolution of chlorine, from the action of the carbonic acid contained in the atmosphere on the compounds, so that a gradual fumigation by chlorine takes place; and where atmospheric impurities abound, the proportion of carbonic acid being generally greater, the fumigation will be more rapid. The following is an abstract of these experiments:

Well saturated chloride of lime being dissolved in water was submitted to the action of carbonic acid gas; chlorine was quickly disengaged, and by continuing the operation a sufficient length of time, the whole was expelled, the liquor no longer possessing bleaching powers, and carbonate of lime having been precipitated.

Air, passed slowly through a saturated solution of caustic potash, to deprive it of carbonic acid, was then made to traverse a solution of the chloride of lime; no chlorine was liberated, no effect of any kind produced.

The chloride of soda is equally decomposed by carbonic acid, only more slowly, in consequence of the solidity of the salt produced.

A filtered solution of the chloride of lime was exposed to the air on the 13th of August; on the 10th of October it no longer contained chlorine; did not affect litmus; and the precipitate from it proved to be carbonate of lime. A stronger solution of the same chloride, exposed to the air on the 16th of August, was found in the same state as the last on the 10th of October.

Air was passed through blood, which had been left to putrefy for eight days; being then passed through a solution of the chloride of lime, carbonate of lime was deposited, and the air was rendered inodorous and completely purified. In a second similar experiment the fetid air was passed through a saturated solution of caustic potash before it arrived at the solution of the chloride; the latter then had no effect upon it, and the air retained its insupportable odour. Another experiment was made with air left twenty-four hours over putrescent blood; the portion of it which was passed directly through the chloride was perfectly purified, but when previously freed from carbonic acid, the chloride had no effect upon it. (Annales de Chimie, xxxiii. 171, and Journal of Science, vol. xxiii.)

These experiments of Gaultier de Claubry *seem* very conclusive, yet a fact is mentioned by Labarraque and Parton, in their report to the Council of Health of Paris, on the removal, from the church of St. Eustache, of the bodies which were deposited there during "the three days" of July, 1830, which tends to show that carbonic acid is not uniformly the agent which decomposes the chlorides and calls into action the disinfecting power of the chlorine. These individuals found this process go on very rapidly indeed, though a bed of lime thickly spread over the floor must necessarily have absorbed the carbonic acid; and hence were led to conclude that an exact theory of the phenomenon still remains to be discovered. (See Report, &c. or abstracts of it in the Medical Gazette for January 1, 1831, which also merits perusal as showing the mode of applying the disinfecting liquid on a large scale.)

The chloride of lime is the preparation which M. Labarraque recommends for disinfecting apartments, while that of soda is especially employed, in topical and external applications, to foul wounds and ulcers, &c. It were needless to enlarge on what is so familiarly known, their power of delaying the occurrence of putrefaction, of arresting it when it has already commenced, and of purifying the tainted air of hospitals, prisons, lazarettos, ships, sick-chambers, sewers, drains, and manufactories in which animal substances in a state of putrefaction are used, and their consequent utility to the anatomist, physician, and, we may say too, police-officers and magistrates.

If an uninhabited place is to be disinfected, troughs or pans, which expose a considerable surface to the air, and containing the chloride of lime, are placed in various parts of the building; the same liquid is poured over the floor, and sheets wet with it are suspended in various situations. If an inhabited ward or apartment is to be kept clear of impurity, the floor must be frequently and freely sprinkled with it, and portions of linen moistened with it should be attached to the bed-curtains, window-hangings, &c. If a putrefying body is to be preserved, it should be kept wrapped in a cloth steeped in it; or, if one is to be exhumed, the same plan should be adopted, with a copious affusion of the liquid into the vault the moment it is opened. It may be poured freely into drains, privies, or night-chairs which emit an offensive odour; and foul sores may be frequently washed with the liquid chloride of soda, diluted, if necessary, with rose-water. The only inconvenience connected with their use is the unpleasantness of the smell of chlorine, which some patients declare to be worse than that which it is employed to correct; but they should be reminded that there is nothing pernicious to life in the smell of the disinfecting liquid, whilst the bad smell of the apartment betokens unwholesomeness.

The subject would be left imperfect did we not inquire into the extent of the power and the mode of action of acid fumigations, in which class we include chlorine, either directly applied or furnished by the chlorides, though not ignorant that the title of chlorine to be considered an acid is disputed by chemists, and though there may be still some doubt as to the mode in which the chlorides affect atmospheric impurities.

It will be at once understood that these agents can produce a beneficial effect only on a limited quantity of air, and that no epidemic constitution existing in the atmosphere of a district or country can be corrected by them. If they are to have any beneficial effect in checking the propagation of febrile diseases, the miasmata which engender such diseases must be existing in a limited space; for if the air which will necessarily replace that which has been disinfected partake of a general contamination, it is manifest that their employment can be attended with no good effect but that of correcting obvious nuisances, such as bad smells. Hence, when these vapours have been employed to prevent the diffusion of a widely-spreading epidemic malady, they have uniformly proved inefficacious, as was shown by M. Nysten and Professor Arejula regarding yellow fever, when it was prevailing in the south of Spain during the years 1800, 1801, 1803, and 1804. Cabanellas, it is true, who was sent by the Spanish government into Andalusia to employ them, thought favourably of their merits, but the weight of testimony is against him; and, besides, he did not employ them till the month of November, when the heat having abated, the intensity of the epidemic must, according to its known laws, have been diminishing. That, employed in a limited atmosphere, they have some effect in checking the spread of typhus, appears to rest on competent authority. Ignorant as we are of the nature of contagion, we are of course ignorant of any specific chemical power they possess of acting upon or decomposing it. All the stronger acids, as we know, possess the property of corroding the animal texture; and their power of acting on contagious matter which is of animal origin, may depend on this property, or on their quality of absorbing or decomposing the noxious gases, which are probably powerful vehicles of contagion, as it is ever found to be least active in the purest atmosphere. That in some way they act on the contagion of typhus rests on the testimony of Guyton Morveau, Carmichael Smyth, and a host of persons of note and character; but the feeling of the profession at large, and we believe that feeling to be a correct one, is that their power over it is limited, and does not supersede the necessity of avoiding needless approximation to the sick, and of adopting every measure of ventilation and cleanliness which art can supply.

That, in a limited atmosphere, they promptly destroy bad odours, is well ascertained, and of all modes of fumigation that with chlorine is the most efficacious in this way: but on what this property depends does not seem very well understood in the case of all of them. Chlorine combines readily with hydrogen, and combines with or decomposes its compound gases; it decomposes, too, ammoniacal gas, and hence there is not much difficulty in understanding how an agent which acts promptly on those gases, the result of putrefaction, and affecting strongly the sense of smell, should be powerful in correcting the more obvious nuisances of infected apartments. But it is not so clear how certain of the other disinfected agents, muriatic acid for instance, the affinity of which for septic gases is less general than that of chlorine, remedy such nuisances, though the experience of Guyton and many others places the fact that they do so beyond all question.

3. It is obvious that the solid matters which are in the infected apartment will receive the beneficial influence of the fumigations employed to purify the air. In addition to this, they should be washed with soap and water, or an alkaline ley; the walls should be white-washed, and air be freely admitted for some time previously to the room's being again inhabited. All body and bed-clothes withdrawn from patients labouring under fever should be thrown at once into hot water, and after remaining there for some time, should be thoroughly washed with soap or an alkaline ley. They should then be hung up in the air for a considerable length of time, and they may be occasionally sprinkled with the chloride of lime.

The ordinary mode of preparing the liquid chloride of lime is as follows:—Introduce into a common retort fourteen parts of black oxyde of manganese, six parts of muriate of soda, the same proportion of sulphuric acid, and twelve parts of water. The chlorine gas will rise without the application of heat, (though, if it is thought desirable to accelerate the operation, heat may be employed,) and should be transmitted through a tube attached to the neck of the retort to the bottom of a vessel filled with a saturated solution of lime. When this is saturated with chlorine, the test of which is the cessation of the evolution of gas from the materials in the retort, it contains about twenty per one hundred of this principle, and may be diluted with forty parts of water for ordinary disinfecting purposes. It is desirable to add the water shortly before employing it, as an extrication of gas commences rather rapidly immediately on the water being added.

The liquid chloride of soda is prepared in the same manner, a solution of one part of subcarbonate of soda in twenty parts water being substituted for the saturated lime-water. The absorbing power of this solution over the chlorine is less than that of the lime-water: hence, when used for disinfecting purposes, the liquid chloride of soda shonld be diluted with only thirty parts of water.

The materials employed for impregnating one or the other of these liquids with chlorine, may be frequently made to evolve more of this principle by the addition of more sulphuric acid, and thus successive quantities of the chlorides may be formed from the same ingredients.

Dr. Henry, of Manchester, has recently performed a series of experiments, which seem to prove that the fomites, or materials impregnated with the infectious principles of various contagious diseases, may be rendered totally inert by exposure to elevated temperatures. Dr. Henry first ascertained that raw cotton, and various kinds of piece-goods manufactured from that or other materials for clothing, are injured neither in texture nor colour by exposure for several hours to a dry temperature of nearly 212°, or even 250°, Fahrenheit. He next ascertained experimentally, that vaccine matter, though capable of communicating the disease after exposure to 120° Fahrenheit, is rendered inert by a temperature of 140°. In the third place, he found that a flannel shirt, which had been worn by a patient in well-marked typhus between the tenth and eleventh days of the disease, was, after exposure for an hour and three quarters to a temperature of 204° Fahrenheit, incapable of communicating the disease to a person, below whose nostrils it was placed for two hours; that a second flannel waistcoat worn on the night between the eleventh and twelfth days, and heated in the same manner, and worn for two hours by the same individual, did not communicate the disease; and that a third worn by the patient on the night between the twelfth and thirteenth days, after exposure to heat and seclusion in an air-tight canister for twenty-six days, was equally incapable of communicating fever. In the fourth place, he found that a series of eight flannel waistcoats worn for several hours by patients in distinctly marked scarlet fever, afterwards exposed to heat varying from 200° to 204°, and eventually worn for several hours by children not having had scarlet fever, did not communicate the disease to these children.

Dr. Henry expresses himself with a degree of caution respecting a positive conclusion being deduced from his experiments on the contagious principle of typhus; but thinks his experiments sufficiently numerous to prove, that by exposure to a temperature not below 200°, during at least one hour, the contagious matter of scarlatina is either dissipated or destroyed. He is more inclined, however, to the latter than the former supposition, because cow-pock matter, though completely deprived of its volatile portion at 120°, is not rendered inert by temperatures much below 140°.

As a disinfectant of articles which are capable of imbibing and retaining contagion, heat, the author suggests, is greatly superior to the vapours or gases used for the same purpose; inasmuch as the transmission of the latter may be stopped by a few folds of compressed materials; while heat, if time enough be allowed, finds its way in spite of all obstacles. He limits the application of the method to the destruction of contagion existing in substances technically called "susceptible;" for instance, to infected clothing of every description; to infected bedding and bed-furniture of every kind that would be spoiled in washing; to trunks and other packages brought by travellers from infected places, and to merchandise whenever it can be shown or rendered highly probable that such merchandise has been in the way of imbibing contagious matter. The apparatus recommended by Dr. Henry is simple, and seems well calculated for the object he has in view. It consists principally of two vessels of copper, or tinned iron, between which steam, the agent employed for transmitting heat to the infected materials, is introduced: but for a full description of the apparatus, and for the plate in which it is represented, we must refer to the Philosophical Magazine and Annals of Philosophy for January, 1832.

In a matter of so much importance, and, we would add too, of such extreme difficulty, it appears desirable that a more ample series of experiments should be performed on the contagious principles of typhus and scarlatina; and that we ought not to rely on mere analogy as a reason for extending to other contagions the procedure recommended, but that these ought likewise to be made the objects of experiment.

JOSEPH BROWN.

DIURETICS, (*Diuretica,* Φάρμακα διουρητικά, from διά and οὐρέω, *meio: Th.* οὖρον, *urina,*) medicines which augment the urinary discharge. This definition might be considered defective, as being too general, but it is the only one that can be admitted; for the excretion of urine, under the influence of diuretics, does not always arise from a direct application of the diuretic substances to the kidneys; but, frequently, from circumstances connected with the state of the stomach, and other organs, under which the kidneys act only a secondary part.

Diuretics are supposed to operate in four distinct ways: 1, by passing into the circulation, and, being conveyed to the kidneys without undergoing any decomposition *in transitu,* acting directly as stimulants on the urinary organs; 2, by suffering decomposition *in transitu,* and acting on the kidneys by one or more of their constituents; 3, by acting primarily on the stomach and primæ viæ, communicating their action to the kidneys by sympathy; and, 4, by stimulating the disordered capillary system to more healthy action,—thereby preventing the undue effusion of fluids into the serous cavities, and permitting the absorbents to convey those already effused into the circulation, to be discharged by their natural excretories the kidneys.*

1. In the healthy and ordinary condition of the body, the blood which is sent to the kidneys is divided into innumerable streams, each of which, entering the glandular glomerules of which these organs are principally composed, supplies the pabulum from which the urine is secreted; whatever, therefore, is conveyed to the kidneys through the medium of the blood must, more or less, affect the natural function of these organs. Thence the inquiry, in what manner is this effected?

If we analyse the urine, we find that it consists of water; urea, a peculiar compound of nitrogen, oxygen, carbon, and hydrogen; small proportions of sulphates of soda and potassa; phosphates of lime, soda, and ammonia; muriates of soda and ammonia; lactate of ammonia and fluate of lime. Knowing that these are the components of urine, it is not difficult to ascertain what substances have passed through the kidneys, and whether these have undergone decomposition. Thus, if free potassa or nitrate of potassa be taken into the stomach in moderate doses, and be afterwards detected in the urine, we may conclude that they have been conveyed to the kidneys through the blood, as they could not otherwise be found in the excretion of these organs. The excretion, however, of these salts does not take place without the kidneys experiencing the influence of their stimulating qualities, and consequently having their natural action so much augmented that a larger than usual supply of urine is the result. On the knowledge of this truth, the first division of the preceding arrangement may be said to be constituted. It is nevertheless a curious fact that, although these substances can be readily detected in the urine, yet they cannot be discovered in the blood; neither can colouring matters, which are easily displayed in the urine, be rendered evident, either in the blood or in the chyle. A doubt was suggested as to the medium through which such matters are conveyed to the kidneys, by Sir Everard Home, who imagined that they found their way through the spleen; but he afterwards properly abandoned this opinion, on finding that, after removing the spleen, and tying the thoracic duct, the colouring matter of rhubarb injected into the stomach of a dog could be detected in the urine. It is sufficient, however, for our purpose, to know that substances taken into the stomach are conveyed to the kidneys;* and that, if they are of a nature to stimulate these organs, provided the stimulus be short of that necessary for exciting inflammation, an increased secretion of urine must follow. It is indeed perfectly obvious that the stimulant influence of diuretics must be within a certain limit; for were the excitement of the kidney sufficient to induce inflammatory action, the urine, instead of being augmented in quantity, would be scanty, high-coloured, and acrid; a fact of great practical importance.

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* This plan of the mode in which diuretics operate is a modification of that of Dr. Paris, (*Pharmacologia*, vol. i. p. 167,) which in its turn is a modification of that suggested by Dr. John Murray, (*Materia Medica*, vol. i. p. 366-8.)

It may not be improper to remark, in this place, that the chief intention of the renal secretion is, probably, the excretion of urea. When both kidneys are taken away from a dog, the animal dies before the ninth day; but, previous to death, the serosity of the other secreting organs affords traces of the presence of urine in it. In reply to this mode of reasoning, it is stated that, in a healthy condition of the body with the kidneys entire, urea has been detected in the perspiration; and that there are instances of persons having passed no urine for many years together, and who yet have suffered no inconvenience;† but these are exceptions to a general rule.

Much of the fluid ingesta passes off by the kidneys, and the quantity of urine excreted is generally proportionate to the quantity of fluid taken into the stomach; thence the necessity of dilution to promote the operation of diuretics. None of the substances possessing diuretic properties require the aid of dilution so much as those in the first division of our arrangement. Without this they would scarcely be conveyed to the kidney, and, if they were, the over-excitement which would be induced would check rather than promote the increase of the urinary secretion.

The action of diuretics is, also, much modified by the function of the skin. When a diuretic is administered, the surface should be kept cool; for if the cutaneous exhalents be stimulated by heat, the medicine determines to the surface, by that law of the system which regulates the balance between the skin and the kidneys as excretories, and sweating supervenes with a diminished discharge of urine; just as in the healthy state, in cold weather, when the surface is chilled, the urine is abundant and pale, whilst in warm weather, when perspiration flows freely, it is scanty and high-coloured. On this account the season of the year, and all circumstances influencing the function of the skin, modify the operation of direct diuretics.

2. Many vegetable bodies and some salts which operate as direct diuretics, undergo digestion, to a certain extent, and only one or more of their constituents reach the kidneys. It is a curious fact, however, that the saline bodies which undergo decomposition in transitu are those into which the vegetable acids enter as components. The acid, which is separated, is decomposed and resolved into its primary elements as if it had been swallowed in its free state; and the alkali being taken into the circulation, is conveyed undecomposed to the kidney, and excites that action in it which promotes the secretion and excretion of the urine. This remark, however, as we shall afterwards prove, is not generally correct; for some salts, compounds of vegetable acids with alkalies, bitartrate of potassa, for instance, operate in a manner which cannot be explained upon the supposition that its alkali only is conveyed to the kidneys. The neutral salts containing the mineral acids are not decomposed, but operate as direct diuretics, as has been already described. Dr. Paris seems inclined to believe that the *bitter principle* is the active ingredient of the vegetable diuretics, which are decomposed by the digestive organs: we are not prepared to deny the accuracy of this opinion; but, if we may reason from analogy, we should be disposed to ascribe the effect to some alkaline principle, which it is probable all of them contain. That other principles of vegetable bodies are separated during digestion, and carried to the kidneys, is evident from the odour which garlic, turpentine, asparagus, and some other vegetable matters impart to the urine; and as these are diuretics, it is not improbable that they possess this quality from the principle, whatever it is, which is combined with or constitutes the odorous matter.

Salts containing vegetable matter in excess, are more diuretic than those which contain the same acids in proportions only to neutralize the alkaline bases with which they are united, in proportion as they are more susceptible of decomposition. Thus, whilst bitartrate of potassa is diuretic, the neutral tartrate is purgative, and exerts no action on the kidney. Something, however, is due to the extent of the dose in which the salt is administered; many substances in small and moderate doses operating as diuretics, which, in large doses, operate as cathartics. This is the case with bitartrate of potassa. Oil of turpentine in doses of ten or fifteen minims up to a fluidrachm, stimulates the kidneys so powerfully as to cause bloody urine, yet a fluidounce purges and produces no perceptible effect on the urinary organs; and in the same manner, when nitrate of potassa has been taken in large doses by mistake for sulphate of magnesia, the symptoms do not indicate any affection of the kidneys.

3. With regard to the third description of diuretics, those which augment the flow of urine, without acting directly on the kidneys, we find that they are substances which, augmenting the nervous energy, give an impulse to the general vigour of the habit, and produce tone. In a weakened state of body the fluids in the serous cavities and cellular texture accumulate; and when the cutaneous system shares in the general debility, anasarca also is the consequence. In such conditions of the body, by augmenting the general tone, the urinary organs also acquire additional vigour; and thence diuresis and the absorption of effused fluids follow the administration of vegetable bitters and other tonics.

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* Alkalies are detected in the urine by testing it with turmeric paper; nitre by dipping a piece of bibulous paper into it, then drying the paper, and applying it to the flame of a candle; if it deflagrate, nitre is present. The odour of asparagus, garlic, turpentine, cubebs, and many other substances, is detected in the urine an hour or two after these substances have been swallowed.

† Dr. Richardson, in a paper published in the Philosophical Transactions of 1713, mentions a lad of seventeen, who had never made any urine.

4. The fourth division of diuretics is one of great importance, and contains, besides mercury, many diuretics, the action of which has been erroneously supposed to depend on their influence on the absorbent system. We shall examine this subject in detail, when we have occasion to speak of the substances that are arranged under this division.

Diuretics, from the increased discharge of urine which they induce, operate as evacuants; but, at the same time, they also exert a stimulant influence. As evacuants, they remove the general plethoric state of the system, and diminish excitement without inducing much debility; for, as the abstraction of fluid from the circulating mass is slowly effected, the vessels contract and gradually accommodate themselves to the lessened quantity of their contents. As evacuants also, diuretics are supposed to carry off acrimonious matters contained in the blood; but the existence of such matters in the circulating mass is very doubtful. As stimulants, diuretics act both on the general and the capillary systems, even when they exert a direct influence on the kidneys. As far as their effects depend on their stimulant properties, they are contra-indicated in all inflammatory states of the kidneys; in which states, and where much irritability is present, the simple diluent diuretics are to be preferred. Water is the best of these; how far it acts a part in all diuretics is not accurately known, but it has undoubtedly an influence in modifying their effects. There is no doubt that copious draughts of water, or any mild aqueous fluids, if not determined to the skin by external warmth, pass freely off by the kidneys, and thus produce an increased discharge of urine.

Among the diuretics which act primarily on the kidneys, without undergoing decomposition in transitu, we find some volatile oils. The **oil of turpentine**, one of these, in whatever manner it may be taken into the habit, rapidly displays its presence in the urine by the odour of violets, which it communicates to that secretion. Its effects, however, as we have already stated, are greatly influenced by the extent of the dose. In some idiosyncrasies it causes a cutaneous eruption closely resembling eczema, in which case it ought not to be prescribed. During its employment neither wine nor spirits should be indulged in, and the ordinary quantity of food should be diminished. **Cajeput** oil, and that of **cubebs** and of **juniper**, operate in every respect in the same manner. They are all employed to excite the action of the kidneys in hydropic diseases; but in effecting this, it is probable that they also influence, generally, the capillary system. The oil of turpentine is the most useful of the three; thence the reason why good English gin is a superior diuretic to Hollands, being rectified on oil of turpentine instead of juniper berries. These volatile oils may be combined with sugar as an oleo-saccharum, and given in any bland fluid, the best of which is the bitter almond emulsion.

Among the inorganic substances belonging to this section of the direct diuretics, **iodine** stands foremost. The alcoholic solution or tincture is the form of the medicine most commonly employed. When administered internally in doses of from ten to thirty minims of the tincture, in a glass of water, twice or three times a day, iodine stimulates powerfully the whole of the glandular system, and, in a special manner, the kidneys. The diuretic effects of iodine, in combination with its general influence on the glandular system, renders it a most useful remedy in ascites connected with diseased states of the liver and the mesenteric glands. Like foxglove, it does not act beneficially when the abdomen is tense; but after tapping and reducing the excitement by a judicious employment of the lancet, it rapidly displays its influence on the kidneys. It seems to be the only decided agent which we possess for stimulating the absorbents, and this extends even to their influence over healthy glands: both the mammæ and the testicle free from disease have in several instances nearly disappeared during its administration. The writer of this article has had occasion to remark its powerful influence on the absorbents most satisfactorily demonstrated in a case of diseased ovarium, which, after tapping, and a course of alteratives with tincture of iodine, carried to the extent of sixty minims for a dose three times a day, was completely cured. In this instance, it is probable that the great advantage arose from the rapidity with which the iodine was thrown into the habit after the tapping, and whilst the flaccid sac remained as a kind of extraneous body in the abdomen. It has never proved useful in similar cases when administered during the turgidity of the ovarian tumor, the growth of which seems to be little connected with the general system, and to depend solely on the local action of its own vessels; the state of tension, therefore, being its natural state, it may be regarded in this condition beyond the sphere of action of agents affecting the general system,—a circumstance, however, which is set aside as soon as the fluid is discharged, and thence it is brought within the sphere of the influence of the iodine.

Some inconveniences arise from the employment of iodine in irritable habits. It causes febrile excitement, which is often accompanied with nausea, vertigo, and headach, and, occasionally, with dysenteric symptoms, and, at other times, symptoms resembling those of paralysis agitans. It, also, in some instances excites perspirations and gripings. Under such circumstances the use of the medicine must be suspended.

A milder diuretic than either pure iodine or its tincture is the *hydriodate of potassa* [**iodide of potassium.**] Owing to its solubility, it is administered in a saturated solution, in doses of *m*xx. to f.℥i. It is incompatible with salts of copper, of lead, mercury, or silver.

The only oxide which has a direct diuretic influence is *potassa*. In the form of the liquor potassæ of the British pharmacopœiæ, it may be administered in very large doses in bland, demulcent fluids. Its primary influence is exerted on the stomach: if any acid be present, it is neutralized; but if the alkali predominate, or no acid be present, it first acts as a sedative, allaying the morbid irritability of the stomach, and then entering the circulation, is carried undecomposed to the kidney, upon which it acts, and can be readily detected in the urine.* As a diuretic, potassa is not extensively prescribed, owing to an erroneous opinion that it is injurious in large doses. The writer of this article, by gradually increasing the dose, has given one hundred minims of the solution of the London College three times a day, for several successive weeks. In these large doses its power in curing the most obstinate cases of psoriasis is very striking, and although its beneficial effects are not evident until it displays its influence on the kidneys, yet it has on no occasion produced any injurious effects. It is not much to be depended on in dropsical affections.

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* It is detected by testing the urine with infusion of rhubarb or turmeric.

Among the neutral salts operating as direct diuretics, **nitrate of potassa** has long held a place. It passes unchanged to the kidneys, stimulating them to increased action, and augmenting rapidly the quantity of the urinary discharge. It can be readily detected unchanged in the urine, on which account it ought not to be administered in inflammatory affections of the urinary organs; but none of the diuretics can be less depended upon in dropsical effusions; even after the phlogistic diathesis has been subdued. It operates in doses of from *gr.* xv. to ʒss, and requires to be largely diluted. The **chlorate of potassa** operates nearly in the same manner as the nitrate, but it is seldom prescribed as a diuretic. There is some uncertainty with regard to the manner in which **borax** (sodæ sub-boras) operates as a diuretic; but, from the smallness of the dose (*gr.* x. to ʒss) required to act on the kidneys, we are disposed to think that it passes entire to these organs. It is readily decomposed by all the mineral acids, common salt, muriate of baryta, and nitrate of silver, all of which, therefore, are to be regarded as incompatible with it in prescriptions.

Those diuretics which undergo decomposition in transitu, and operate directly on the kidneys by one or more of their constituents, comprehend substances from the three kingdoms of nature.

The only animal diuretic is **cantharideu**,* [or cantharidin,] as contained in the blistering beetle, cantharis *officinalis*, and the milabris *variabilis*, which has lately been introduced from China. The cantharideu has not yet been employed in its separate state as a diuretic, but the influence of the blistering beetle on the urinary organs has been long known. Hippocrates employed it in dropsies, and a celebrated diuretic of Tulpius consisted of the tincture of Spanish flies, cardamoms, and sweet spirit of nitre. The internal use of cantharides, however, requires the utmost caution, and when thus employed, whether in the form of powder or of tincture, the freest use of diluents of a demulcent kind is absolutely necessary. In the form of powder, cantharides, in doses not exceeding two grains, stimulate the kidneys, and cause an increased flow of urine; and it is singular that neither heat in the region of the kidney nor strangury is experienced in this case. They have been found beneficial in ascites, in old worn-out constitutions. When accidentally over-dosed and inflammation of the kidneys supervenes, with bloody urine, insupportable pains in the abdomen, strangury, vomitings, or convulsions, the lancet must be freely employed, with copious dilution, and an enema of warm water, containing from *m*xx. to *f.*ʒi. of tincture of opium. The employment of oil must be avoided.

The **balsam of copaiba, cubebs,** and the fruit of the **juniper,** owe their diuretic properties solely to the volatile oil which they contain, and which, separated from their other components during the process of digestion, is carried to the kidneys, and augments their natural function; it may be readily perceived by their odour in the urine. Copaiba in an over-dose causes inflammation of the kidneys; consequently, it ought to be carefully avoided when there is the least tendency to ulceration of these organs. It may be administered either in a fluid or a solid form. In the first it is given, combined with mucilage and any bland fluid, in doses of from twelve to thirty minims; or the volatile oil, separated from the resin by distillation, may be rubbed up with, sugar, and administered in bland fluids, as an oleo-saccharum, in doses of from ten to twenty minims. The solidification of the copaiba is best effected by magnesia, in which state it may be formed into pills;† or, for the same purpose, it may be formed into a soap, as the union of the alkali does not, in any degree, diminish the efficacy of the balsam. In moderate doses, from *gr.* x. to ʒss. of the powder, cubebs are diuretic; in larger doses they are purgative. It is probable that some of the benefit derived from their employment in gonorrhœa may be ascribed to the diuretic influence of the volatile oil so much increasing the urinary discharge as to enable it to wash out the virulent matter in the urethra. We are not aware that they have been employed in dropsical effusions.

In the same manner as the digestive organs separate the volatile oil of cubebs and juniper-berries, they separate veratria, the active principle of the **colchicum autumnale,** and scillitina, that of the **scilla maritima,** from the powder of the dried bulbs of these plants. Although colchicum, in full doses, acts powerfully on the excretory ducts of the liver and the pancreas in the duodenum, and brings down a large quantity of bile into the intestinal canal, yet in small doses the veratria is separated, taken into the circulation, and stimulates the kidney. As a diuretic, however, it is less powerful than the squill, a circumstance altogether depending on its disposition to run off by the bowels. For diuretic purposes the tincture is the best preparation of the colchicum, as the alcohol takes up the gallate of veratria, which is less liable to pass the pylorus undecomposed than the acetate, which is always formed when either vinegar or wine is employed as the vehicle for taking up the active principle of the plant, and which passing the pylorus, and bringing down a large quantity of bile from the liver, almost invariably purges. Both the petals and the seeds of the colchicum yield the same active principle to alcohol, wine, or vinegar, as the bulb. The dose of the dried bulb, in powder, is from five grains to twelve grains, that of the tincture or the wine from *m*xx. to *m*lx., and that of the vinegar from f.ʒss. to f.ʒi. Upon the whole, however, the preparations of colchicum are much less to be confided in, where morbid accumulations of fluid are required to be lessened, than those of the squill; and it only proves useful as a diuretic when it exerts little influence on the intestinal canal. It, nevertheless, cures dropsies by its stimulant influence on the capillary system, and by its evacuant properties, when given in larger doses than those mentioned as fitted to secure its diuretic influence. Squill is given in substance to secure its diuretic effect; but it is generally prescribed in combination with calomel or the blue pill, or bitartrate of potassa. As a full dose given at first is apt to induce vomiting, it is preferable to commence with doses of a grain of the powder, gradually increasing the quantity to six grains, repeated every fifth or sixth hour. Cullen recommends the bichloride (oxymuriate) of mercury instead of calomel, as an adjunct to squill; but every intention is sufficiently answered by the calomel, and it is much less likely to irritate the bowels. If the combination of squill and a mercurial act on the bowels, the latter must be discontinued, and the mercury introduced by the surface. In some habits, owing to idiosyncrasy, squill excites an eruption on the skin not unlike nettle-rash, accompanied with severe gripings, cold sweats, and occasionally convulsions; in which case the use of the remedy should be discontinued, and cordials with opium administered. Squill is most useful as a diuretic, in doses not exceeding eight grains of the dried bulb: it is incompatible with the alkaline carbonates, astringent vegetable infusions, and solutions of the sulphate of iron.

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* Cantharideu, in its separate state, is a white substance, in minute micaceous scales, insoluble in water and cold alcohol, but soluble in boiling alcohol, ether, and oil. The knowledge of its solubility in oil is a fact of much practical importance in cases of poisoning by cantharides, in which the administration of oil, by dissolving the cantharideu, tends to diffuse the acrid influence of the poison, and consequently ought never to be resorted to.

† This is effected by mixing the balsam with one-third of its weight of magnesia, spreading the mixture upon a plate, and exposing it to the action of the air for ten or twelve days. It then becomes plastic, and may be readily formed into pills. The activity of the copaiba is not diminished by its union with the magnesia.

A decoction of the twigs of the common broom, **spartium scoparium,** has been employed as a diuretic from time immemorial: although nothing is known respecting its active principle, yet whatever it is, the decoction seldom fails to excite the action of the kidneys. As little is known respecting the active principle of **sarsaparilla,** but it certainly affects the kidneys; the alterative influence, however, of this root, can scarcely depend on its diuretic properties; and amidst so many better diuretics, it might be rejected from the list without any inconvenience being experienced by its removal.

Amongst the inorganic diuretics which undergo decomposition in transitu, are **salts of potassa** and **soda,** the alkalies of which only are transmitted to the kidneys. The carbonate and the bicarbonate of potassa, although the one contains double the quantity of carbonic acid of the other,* both operate nearly in the same manner as diuretics; a circumstance owing to the reduction of the latter to the state of the carbonate, during its decomposition in the stomach. The dose of the carbonate is from ten grains to ʒss, but it may be augmented to three drachms; the bicarbonate may be given in double that quantity. The properties of either, as diuretics, are not lessened by administering them in the state of effervescence with lemon-juice or citric acid; this acid being separated during the digestive process in the same manner as the carbonic; and if any febrile heat be present, this is the best method of administering these carbonates. The same opinion may be given of the carbonate and bicarbonate of soda, which, owing to their taste being less disgusting than that of the carbonates of potassa, are more generally employed as diuretics.

The acetate of potassa has considerable claims to attention as a diuretic, if it be not over-dosed, for in doses exceeding ʒi. it operates as a purgative. In small doses it may be conjoined with infusion of gentian, or that of any light bitter: it operates with more certainty in small doses frequently repeated, than in full doses taken at long intervals. We have seen it ordered in conjunction with bitartrate of potassa; but in this combination the diuretic influence of both salts is destroyed, and a tartrate of potassa is formed by the decomposition of the acetate, and the abstraction of the superabundant tartaric acid from the bitartrate, which purges. The bitartrate in small doses, from gr. x. to ℈i, is a much more useful and certain diuretic than any of the other neutral salts in this division of this order of medicines. We are by no means satisfied that the influence of this salt depends on its alkali finding its way to the kidneys; for, when we reflect that ℈i of the bitartrate contains gr. v. only of potassa, and that twenty minims of the liquor potassæ contain gr. vii. of potassa, and that the diuretic effect of the ℈i of bitartrate is much greater than that of *m*xx. of the liquor potassæ, there appears undoubtedly some difficulty in assenting to the accuracy of the theory which has been stated. The influence of the bitartrate in ascites is well authenticated, and every day's experience confirms the confidence which has been placed in its diuretic powers. The emaciation which the bitartrate causes when taken as ordinary beverage, however, depends on its operation on the intestinal canal. Bitartrate of potassa is beneficially conjoined with squill or colchicum, or with bitter infusions; or, if the salt, when administered alone, have weakened the digestive organs, in combination with tartarized iron. In cases connected with glandular obstructions, we have given it at the same time that iodine was externally applied in the form of an ointment, and always with benefit: and here the dose of the bitartrate may be the same as if the iodine were not employed. The soluble salt, formed by the union of the sub-borate of soda with the bitartrate of potassa, operates, also, powerfully as a diuretic.

Some very active agents are found capable of producing a diuretic effect on the system by stimulating the capillaries to more healthy action, and thus enabling the absorbents to take up fluids already effused in the serous cavities and cellular membrane, and to throw them upon the kidneys, their natural excretories. Tobacco is one of these:

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[*] Carbonate of potassa.

Potassa, 1 propor............	= 48	or 68·57
Carbonic acid, 1 propor.......	= 22	— 31·43
Equivalent....	70	100·00

Bicarbonate of potassa.

Potassa, 1 propor...............	= 48	or 47·53
Carbonic acid, 2 propor......	= 44	— 43·56
Water, 1 propor...............	= 9	— 8·91
Equivalent....	101	100·00

it was introduced to the notice of the profession by Dr. Fowler, for this purpose; and when administered in small doses, either in the form of infusion or of wine, so as not to nauseate, it has been given successfully in dropsy. No diuretic, however, requires so much caution in its administration under the most favourable circumstances; and, therefore, it has been less employed than it deserves to be.

Much of the efficacy of **foxglove** depends on the period of the growth of the plant at which the leaves are collected, and the manner of drying and preserving them. In the months of July and August they are in the best state: they should be then gathered, and dried between colourless bibulous paper, in a warm room, and under a moderate pressure. This may appear to be an unnecessary degree of care and trouble, but for the preparation of a medicine of so much activity, and which is administered in grain doses, too much attention cannot be bestowed to preserve all its medicinal powers in the only way in which they can be obtained. When the dried pulverized leaves lose their green colour, some chemical change has taken place in them which deprives them of their native properties. In employing foxglove as a diuretic, it should be recollected that its influence on the capillaries is not obtained in states of the habit exceeding the limits of the healthy standard of tone. In states below that point, it stimulates the capillaries, and diminishes the force and frequency of the pulse, and operates as a diuretic; for in dropsical effusions, whether those of ascites or hydrothorax, no benefit can be expected from the employment of foxglove, as long as any tension of the vascular system exists. It is after tapping and a reduction of arterial action, that decisive advantages are obtained from prescribing foxglove in hydropic affections. It is on the same principle that it is most useful in lax, pale, leucophlegmatic habits; and, if the disease be anasarca, in those cases in which pitting is left on pressure of the affected parts: thence, when this state does not exist, the system must be lowered by bloodletting and purging, before any advantage can be expected from foxglove as a diuretic. It has been found useful to combine it with mercurials, especially the blue pill; and pushing this far enough to affect very slightly the salivary glands: but in cases of either anasarca or ascites, the best adjuncts are bitartrate of potassa, acetate of ammonia, or colchicum; and in constitutions broken down by protracted courses of mercury, the nitric acid.

When foxglove is administered in the form of powder, the dose may be gr. i. repeated for the first two days at intervals of eight hours; after which the intervals should be lengthened according to the effects produced. An infusion made by macerating one drachm of the dried leaves in f.℥viii. of boiling distilled water, and f.℥i. of cinnamon water, for four hours, speedily produces the diuretic effects of the plant, when given in doses of f.℥i. repeated at intervals of five hours. The dose of the tincture should not at first exceed ten minims; but it may be gradually increased until its diuretic influence be perceived. The symptoms of an overdose are nausea, vomiting, vertigo, pulsation in the temples, a sensation of heat throughout the body, sweating, sometimes diarrhœa, and occasionally salivation. One remarkable symptom sometimes occurs, a suppression of urine. The best antidotes, under such circumstances, are, ammonia, brandy and water, opium, and the stimulus of a blister applied over the pubis. One circumstance is particularly necessary to be noticed in prescribing digitalis—its power of accumulating in the system, like mercury, and suddenly exerting its specific effects when not expected. No medicine, therefore, requires to be more closely watched, whether it be given in moderate doses, long-continued, with the view of obtaining diuresis; or administered in gradually augmented doses, to lull delirium and procure sleep in mania. Whenever nausea is felt, it must be noticed and suppressed; for vomiting arrests the diuretic influence of the remedy.

Little requires to be said of **lactucarium** as a diuretic. It has been found useful in hydrothorax, and some other cases of dropsical effusions, by the German physicians; but in this country its place is much better supplied by foxglove.

All bitter tonics possess, more or less, diuretic effects; but the **seneka** root is perhaps better adapted for this purpose than any other: its influence is particularly felt in those cases in which the serous accumulations are the effect of general debility; as for example, those cases of asthenic ascites which sometimes follow acute diseases. In such cases, also, much benefit is obtained from the **ferrum tartarizatum,** which, besides operating as a tonic, has a direct diuretic influence, and has been found peculiarly serviceable in cases of anasarca connected with affections of the heart; but in these cases its employment must be preceded by purgatives and mercurials. With respect to the employment of **mercurials,** much benefit is derived from their aid in promoting the operation of other diuretics. Thus the diuretic effects of squill are rendered more certain when combined with calomel; and those of digitalis when united with the blue pill. In both instances the stimulant influence of the mercurials on the capillary system aids that of the active principle of the other diuretics, and more benefit seems to result from such combinations than when either is administered alone.

From the view which we have given of the substances most commonly employed as diuretics, the practical employment of them as remedial agents may be very briefly stated. In febrile affections much must be done before prescribing diuretics; but in long-protracted fevers, whether intermittents or continued fevers, if œdematous swellings occur, their use is indicated and must not be delayed. If they be prescribed during continued fever, it should be recollected that one of the most distressing occurrences in that disease is retention of urine; and, therefore, in prescribing diuretics, it is highly requisite to examine daily the state of the bladder. Most fevers in their termination display critical changes either in the quality or the quantity of the urinary discharge: under such circumstances, it becomes a question—how far are diuretics likely to favour such a crisis? At the commencement of fevers the urine is generally pale; it becomes afterwards high-coloured; and at the termination of a paroxysm, if the fever be intermittent or remittent, or, when it begins to decline, if it be of the continued type, a sediment either lateritious or of a pale pink colour is deposited, and has been regarded as critical. But this sediment is to be regarded rather as the result of a certain catenation of actions, than as the excretion of any thing injurious to the habit; and, were diuretics able to promote it, they would be of no avail. Upon the whole, therefore, even as simple evacuants, diuretics are of little value, either in idiopathic fevers, or in acute diseases in which fever is a symptom. They have been advantageously administered in many chronic affections, especially those accompanied with eruptions on the skin; but the chronic affections in which their influence is truly beneficial are *dropsies*. This class of diseases depend on such an atony of the capillary system, that instead of the capillaries carrying forward the fluids they contain, they pour them out into the serous cavities, and thence the balance between the exhalation and absorption which exists in health being broken, the effused matter is accumulated to a degree which overpowers the absorbents. Diuretics are prescribed to cure dropsies in nearly every form; and do so by stimulating the capillary system, so that no fresh effusion taking place, the absorbents are enabled to take up the already effused fluid, and to throw it upon the kidneys, its natural emunctory. When success attends the administration of diuretics in dropsy, one advantage resulting from their employment over drastic purgatives and some other remedies is, the little debility which they occasion. If diuretics, however, be given alone, they are uncertain in their effects, and seldom in that case deserve more than the title of palliatives; but, as adjuncts to other means, they aid materially the evacuation of the effused fluid, and have thus frequently effected the removal of general dropsy. Their success, however, is very precarious; and so many circumstances interfere with their operation, that it is difficult to form a prognosis of their expected effects. Sometimes they operate freely, increasing greatly the discharge of urine, and yet the dropsical swellings continue. In this case some organic mischief must be looked for; and unless this can be removed, no great advantage can be expected from the evacuation of the effused fluid.

The kinds of dropsies in which *direct* diuretics have proved most beneficial are anasarca and ascites; whilst those which operate by diminishing arterial action, and augmenting that of the capillaries, are the best adapted for hydrothorax. But even in any case the influence of diuretics hinges upon so many accidents, that all of them are precarious in their effects. In encysted dropsies they are utterly useless, unless preceded by reducing the sac to the state of an extraneous body.

Diuretics have been much prescribed in calculous diseases; and most of the substances called lithontriptics are diuretics. We have ample proofs that none of them act chemically in dissolving calculi; nor, indeed, can they be said to be capable of effecting any change on the kidneys sufficient to prevent the formation of calculous matter. It is probable that the benefit accruing from their employment is wholly due to their influence on the digestive organs; and by their aiding in the formation of a better gastric juice, the digestive process being rendered more complete, all the secretions, and consequently all the excretions, must necessarily become more healthy. and cease to deposit the uric and other acids in the pelvis of the kidney.

In conclusion, we would say that the efficacy of this order of remedies depends more on the tact of the prescriber, and his intimate acquaintance with the changes, both structural and functional, which disease produces on the system, than any other. The operation of no other order of medicines is so much modified by circumstances; and no other medicines require so much attention as these for insuring their beneficial effects. The following rules ought always to be strictly observed during the administration of diuretics.

1. The surface of the body must be kept cool.
2. The use of diluents is essential, and ought always to be urged, more especially when the saline diuretics are employed.
3. The patient should, if possible, be out of bed during their operation.
4. The diuretic should be administered in the day-time.
5. After the accumulated fluid has been removed from the serous cavities, and the use of the diuretics suspended or discontinued, tonics should be prescribed.
6. Little advantage can be anticipated from the employment of diuretics in those dropsies which originate from organic affections of the liver or the chylopoietic viscera, and still less in encysted dropsy. It is only in those cases connected with debility and deranged action of the capillary system, that diuretics can be regarded as certain remedial agents.

A. T. Thomson.

DROPSY. (From the Greek, ὕδρωψ — Latin, *hydrops:* — Th. ὕδωρ, *water*, and ὤψ, the *look* or *aspect*.) Dropsy is a common term signifying effusion into the cellular tissue, or into any of the natural cavities of the body. With the addition of the epithet *encysted*, it has likewise been employed to designate a very different series of affections, viz., those collections of serous fluids which are contained in factitious sacs, and of which the ovary is more peculiarly the subject. These, as having neither the same origin, nor admitting the same treatment, will be spoken of in a separate article.

Even real dropsies differ so much from each other, in consequence of the organs in whose neighbourhood or in whose substance they form, that they cannot all be comprehended in one article. Thus hydrocephalus, though agreeing in having as one of its terminations an effusion of serum into the ventricles of the brain, can by no means be regarded in the same light with effusion into the larger cavities of the body. Its progress is more rapid, its origin more decidedly inflammatory, and, when it assumes a chronic form, it never gives rise to anasarca, which almost constantly attends hydrothorax or ascites. Hence, therefore, under the common head of dropsy, we can only consider this and other local dropsies, so far as the same theoretical explanations of their phenomena agree with each other; and our chief attention must be paid to the form, origin, and treatment of what is commonly denominated general dropsy. For the peculiar symptoms by which hydrocephalus, hydrothorax, and hydrops pericardii are indicated, we refer to the articles under which these affections are treated.

The ancients appear to have had very crude notions of the cause of dropsy, and any approach to a rational theory of the disease is of very modern origin. Hippocrates explained its occurrence by the corruption and softening of the flesh, and its conversion into water. Celsus states that the common cause of dropsies is too great an abundance of humours. Galen, attempting greater refinement, referred it to refrigeration of the liver, which he assumed might happen either from an affection of that organ itself, or from sympathy with other organs; and with little modification this theory of Galen was received in the schools till after the discovery of the lymphatics by Asellius.

Forestus, who wrote in the latter part of the sixteenth century, adopts the opinion of Celsus, and explains it by the theory of Galen. He assumes that in consequence of the refrigeration of the liver, the veins also become refrigerated: hence a more serous state of the blood and greater abundance of water; and hence, according as the affection is local or general, anasarca or ascites is produced.

Fernelius, apparently seeing the insufficiency of this theory, referred anasarca to refrigeration of the liver, and ascites to a rupture of the vessels which contained the humours. By these, however, it is scarcely possible that he could intend the lymphatic vessels, as he wrote before the discoveries of Asellius had been published, and long before these vessels were supposed to be so general as it is now known that they are.

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Such is a short outline of the attempts which have been made to explain the phenomena of dropsy; and at the beginning of the present century the general opinion seems to have been that the disease depended upon defective absorption, and that it was essentially a disease of debility. The investigations of various writers into the causes and treatment of hydrocephalus, which served clearly to prove that this disorder had very frequently an inflammatory origin, naturally tended to re-open the general question; and Blackall, Abercrombie, and many others were led to teach that both anasarca and ascites are often attended with and dependent upon inflammation. Former writers had indeed given examples of dropsies successfully treated by bloodletting; but these for the most part were single cases; and no attempt to lay down any general plan had been made till the time of the writers just referred to. Multiplied experience has now determined the question of treatment; and that in many cases an antiphlogistic plan is requisite, is no longer a matter of doubt. But whether dropsy depends upon increased exhalation or diminished absorption, is yet undecided; nor do we feel that the facts are sufficiently numerous to determine the dispute. We shall shortly give the principal arguments for either theory.

That dropsy proceeds from deficient absorption is argued, because, whether we consider the veins or lymphatics the instruments of this function, pressure upon their trunks is followed by an effusion of serum into the parts farthest removed from the heart. This, indeed, till some late experiments by Magendie, was the only real fact which could be adduced in favour of diminished absorption. This physiologist, by inducing an artificial plethora, and then showing that the function in question was less actively exercised than in those cases where no such plethora existed, has certainly given additional probability to the theory, and, under any circumstances, has proved what before was purely hypothetical—that absorption is capable of being diminished. On the other hand, that increased exhalation is the cause, is argued from the circumstance that absorption actually proceeds in dropsy, that the fat is taken away, and that emaciation advances *pari passû* with the effusion; that this function is always the last to yield, and that it appears to become more energetic in proportion to the general debility of the system; that the exhalents are capable of pouring out very different quantities of fluid, as is seen in the secretion of tears, the sudden increase of perspiration, &c.; and, lastly, that the fluids effused are different from the natural secretions of the parts, containing a much greater quantity of serum; and that this difference would not exist if dropsy were the simple result of diminished absorption.

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Something may attach also to the condition of the blood, but upon this point we have very little satisfactory information. That hemorrhages increase the serous portion of the blood, and that profuse hemorrhage gives rise to dropsy, is certain; and that in dropsies, more especially those accompanied with extreme debility, the blood often exhibits a remarkable difference in the proportions of serum and fibrine, in its coagulability and in its colour, is likewise certain; but we have yet no data by which to connect these phenomena with dropsy as cause and effect.

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These differences, however, are found to affect principally, if not exclusively, the animal matter only of dropsical fluids; the saline matters being by no means subject to similar variations.

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The caustic alkali contained in these fluids, Dr. Marcet proceeds to say, appears to be combined with the animal matter in a manner not well understood, and the proportion of the uncombined alkali to the other salts is greater as the specific gravity is more considerable. To this account of the animal fluids Dr. Marcet has subjoined the following table, to show the proportions of saline and animal matter in various dropsical or serous fluids, and in the serum of the blood.

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Hydrothorax	1012.1	26.6	18.8	7.8
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Hydrocele	1026.3	80	71.5	8.5
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attention must be paid to the form, origin, and treatment of what is commonly denominated general dropsy. For the peculiar symptoms by which hydrocephalus, hydrothorax, and hydrops pericardii are indicated, we refer to the articles under which these affections are treated.

The ancients appear to have had very crude notions of the cause of dropsy, and any approach to a rational theory of the disease is of very modern origin. Hippocrates explained its occurrence by the corruption and softening of the flesh, and its conversion into water. Celsus states that the common cause of dropsies is too great an abundance of humours. Galen, attempting greater refinement, referred it to refrigeration of the liver, which he assumed might happen either from an affection of that organ itself, or from sympathy with other organs; and with little modification this theory of Galen was received in the schools till after the discovery of the lymphatics by Asellius.

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In this case the anasarca takes place very suddenly, the whole cellular tissue sometimes becoming in a few hours enormously distended with fluid; and there is considerable heat of skin, with a full and hard pulse, furred tongue, and much thirst. Not unfrequently the patient complains of tenderness over almost the whole surface of the body, especially if strong pressure be made, so that we might be induced to believe that the cellular tissue under these circumstances is in a state of inflammation. The bowels are generally costive; the urine coagulates on boiling, the precipitate thus formed being very various in quantity,—sometimes scarcely rendering the urine at all muddy, at others forming almost a solid mass. This state of the urine, it has been inferred, is conclusive of disease in the kidney;* but we shall in the course of this article afford reason for questioning this inference: it certainly indicates a disordered function of this organ, and not unfrequently accompanies structural disease of it.

Much more frequently acute dropsy is accompanied by inflammation of the lungs or pleura, and sometimes of both. The pulmonary symptoms, however, are not always very prominent, and they sometimes nearly disappear when the effusion has taken place. In such cases, inquiry into the history of the patients generally shows that they had suffered for several days, or occasionally several weeks, from cough and dyspnœa, and that about the period at which these symptoms diminished in severity, the face was perceived to swell in the morning and the legs at night, and the abdomen, without being very perceptibly enlarged, would not allow the clothes to be buttoned or laced so tight as usual. From this time the swellings increase rapidly; the whole cellular tissue becomes affected, and the countenance is very leucophlegmatic in appearance. At other times the pulmonary symptoms and effusion proceed *pari passu*, or the former precedes the dropsy only by a few hours, but is not relieved by the occurrence of effusion.

The progress now described is generally exhibited in the acute anasarca, from whatever source it may have derived its origin; but not very seldom effusion takes place to a considerable extent into the abdomen at the same time, and the ascites quickly becomes equally marked, if not the more prominent symptom.

Ascites is much less frequently an acute disease than anasarca, and in most cases is the result of previous inflammation. In the article Ascites we have described several instances of this kind.

The exciting causes of acute dropsy are,—the repression of eruptions, the sudden suppression of perspiration, suspension of the catamenia, or of any other customary evacuation, inflammation of the lungs and pleura, exposure to cold, &c. It also succeeds scarlet fever, when this disease has run its regular course; sometimes it has succeeded parturition, coming on suddenly and without any pain. In this last case, ascites alone is often observed; but at other times it is accompanied by excessive anasarca. The ascites succeeding parturition is also at times very manifestly dependent upon peritoneal inflammation, and is attended with fever, quick, small, wiry pulse, and excessive tenderness of the abdomen, &c. These symptoms precede the effusion, and the tenderness diminishes, but does not entirely disappear upon its occurrence. In some of these cases, when the abdomen has been emptied, we have discovered an enlarged ovarium, and we are inclined to believe that it is to the irritation produced by disease of this organ, with the additional stimulus of the puerperal state, that the effusion is owing. The termination of such cases is various: in some, after the disappearance of the dropsy, the tumour remains quiescent, and is not attended by any inconvenience; in others the ascites, indeed, is removed, but the ovary continues to enlarge, and we have at length encysted substituted for peritoneal dropsy.

Dropsy may be acute as to the rapidity of its formation, and yet be the very reverse of an inflammatory disease. This variety is, however, much more rare than the preceding species, but, like it, assumes the form of anasarca or of ascites alone, or of both together. It comes on in general very rapidly, and is unattended by fever or any symptom of increased arterial action. In the article Anasarca an instance has been mentioned, taken from Dr. Bateman's reports of Diseases in London, where it came on after excessive fright, and was removed by the administration of cinchona. In the form of ascites we have several times seen it follow parturition; the patient being, within a few days of delivery, as large or even larger than at the period of labour. In these instances the only striking symptom is debility; there is neither thirst, nor heat of skin, nor quickened pulse; and the patient appears to suffer no other inconvenience from the effusion than what proceeds from the increase of her bulk. The progress of such cases towards recovery is very slow, and is always impeded by violent depleting remedies. The most successful plan of treating this affection is generally by slight tonics, frictions over the bowels, and bandaging. It ought, however, to be remembered that such patients are liable to become the subject of sub-acute inflammation; and unless great watchfulness be practised, the disease from this cause may become incurable.

Of the same asthenic character are those forms of effusion which are the consequence of any excessive discharge, and more especially hemorrhage. We have mentioned one instance in the article Anasarca in which the hemorrhage was the consequence of diseased uterus; and the anasarca (the form such dropsies generally assume) appeared and disappeared, as the hemorrhage prevailed or was suspended. Any other debilitating discharge will unquestionably lead to similar results.

II. We shall now proceed to notice those species of effusion which are always the result of some organic disease, and which may therefore be termed symptomatic or secondary dropsies. They are usually chronic in their course, are seldom attended with acute inflammation, but very frequently accompanied with sub-acute inflammation.

Dropsy from Disease of the Heart.—[*Cardiac Dropsy.*]—This species of effusion is usually preceded by the common symptoms of disease of this organ, and such disease may precede, and often does precede, the occurrence of dropsy for months, and even for years.

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* Dr. Bright, however, to whom this notion owes its origin, by no means carries this doctrine so far.

The first symptom of dropsy arising from disease of the heart is usually observed in the face, the eyelids being puffed in the morning, and an unusual difficulty of opening them being experienced. This single symptom frequently endures for a very considerable time before any farther progress is observed. Next, the feet swell at night, and the upper extremities become very quickly the site of effusion, and the left arm earlier and more frequently than the right.

The anasarcous swelling, which is peculiarly pellucid, usually long precedes the occurrence of ascites; effusion taking place in the peritoneal cavity late in the disease and very slowly. Frequently, indeed, patients are examined, in whom anasarca has been the consequence of cardiac disease, without a single ounce of fluid being found in the abdomen; and sometimes, although more rarely, not even in the cavities of the pleuræ. The pulse is not always characteristic of disease of the heart; and of course the same difficulty must naturally occur in detecting such disease, whether accompanied or not accompanied by dropsy. When, however, effusion begins after long disease, and without pulmonary symptoms, in the face and upper extremities, we may always suspect the heart to be the source of the effusion. In many patients, and particularly in women, this first symptom appears to be followed by partial effusion into the chest, and for some weeks before any farther progress is made, the patient is unable to lie down. At first this difficulty of preserving a reclining posture is very slight, and only an additional pillow is required, the patient at this time being scarcely sensible that the inability of lying down is the consequence of disease. Gradually, however, the effusion increases, progressively involving every part of the system — the cellular texture and the cavities of the brain, pleuræ, and peritoneum.

The urine in some of these cases at a very early period affords a very slight deposit of albumen upon boiling, and this albuminous secretion becomes more and more abundant in the progress of the disease. Its quantity varies considerably. In a patient who died in the Birmingham Hospital during the present year at a very early stage of the effusion, two months before his death the urine was barely rendered turbid, but the evening he died it was rendered nearly solid, by boiling. On dissection, the heart was found enormously enlarged, and the aorta very much diseased. The kidneys were perfectly sound. The urine, however, does not coagulate in every case of dropsy arising from disease of the heart, nor is it very easy to say what is the precise state of the system in which this phenomenon does occur.

None of the species of dropsy is more frequently relieved, or we may say for a time even cured, than this; but it very frequently recurs, and at length, favoured by the exhaustion from long disease, and sometimes perhaps even by the remedies that have been necessarily employed, a very copious effusion takes place into the chest, and death often at last occurs very suddenly. Sometimes, and this is no unusual occurrence, the anasarca permanently disappears for some time before death, or remains but in a very slight degree. The oppression of the chest, however, is not diminished, and occasionally a greater determination of blood takes place to the lungs, or these organs become congested, especially if much obstruction occurs in the valvular structure of the left side of the heart. At this period hæmoptysis, acute pneumonia, and pleurisy, are very liable to ensue, and require the most decided antiphlogistic treatment. Even this treatment does no more than afford temporary relief, and inflammation occurs again and again, till the means of the physician are exhausted. To stimulate increases the inflammation, and farther depletion is rendered impossible by the extreme debility of the patient.

The course now described is not peculiar to any one affection of the heart; the symptoms are, more or less, the same under every malady of that organ. Some difference nevertheless exists according as the heart is the subject of what Corvisart calls active or passive aneurism; congestion and inflammation being more common in the former affection than in the latter. Often, indeed, when passive aneurism exists, advantage is derived from the lighter tonics united with diuretics, but active depletion is neither called for nor admissible: it reduces the patient without benefiting him as regards the disease.

Dropsy from Disease of the Lungs. — Under the head of ANASARCA we have given several instances of this affection, when arising from or connected with inflammation of the lungs. For the phenomena attending it under such circumstances, we refer therefore to that article. It is not, however, only after inflammation of the parenchymatous structure of these organs that effusion occurs; it arises also after chronic bronchitis; after chronic pleurisy; and frequently, perhaps generally, in a greater or less degree, in the latter stages of tubercular phthisis.

The phenomena of dropsy, when arising from chronic bronchitis, do not materially differ, excepting as to the rapidity of its progress, from a similar affection after inflammation of the lungs. The face and upper extremities are in both cases the first to become œdematous. Sometimes this œdema is so slight, that it produces only slight stiffness at first waking in the morning, and is scarcely—occasionally not at all—recognised by the patient as the consequence of any swelling of the eyelids. At a shorter or later period after this, the ankles swell, and the affection in this stage may remain nearly stationary for months and even for years. As, however, chronic bronchitis is liable to pass at particular periods into a sub-acute, sometimes even into an acute form, there is usually at the same time an increase in the effusion, which will thus be found to increase and subside with every aggravation or alleviation of the original malady. We have in this manner known an individual pass seven or eight years without any material alteration; in the summer enjoying a tolerable state of health, in the winter threatened with a fatal termination from fresh attacks. It ought also to be observed, that each attack leaves the individual in a less favourable state than before. At length the dropsical effusion begins to increase more rapidly; the whole cellular texture becomes anasarcous; fluid is poured out into the cavities of the peritoneum, the chest, and the brain, and death ensues from the affection of one of these latter cavities. Sometimes the pleuræ, the pericardium, and the cellular texture of the lungs become so dropsical, that the patient is unable to lie down, and at last appears to die from suffocation; and not unfrequently death takes place very suddenly under such circumstances. Another termination is in effusion into the ventricles of the brain, and the patient dies with the common symptoms of apoplexy, or falls into a doze, and imperceptibly passes from a state of sleep to actual death.

To this general description of the course which dropsy from chronic bronchitis pursues, is to be added, the supervention of fresh symptoms as additional organs become involved. Thus palpitation of the heart supervenes with the effusion of fluid into the pericardium; the dyspnœa increases with the increase of effusion into the pleuræ or the cellular tissue of the lungs; the digestive organs become more disturbed as their functions are interfered with by the pressure of fluid within the cavity of the peritoneum; and if the brain is involved in the general disposition to dropsy, stupor, paralysis, or apoplexy, may and not unfrequently does ensue.

Dropsy likewise takes place in the latter stages of chronic pleurisy and tubercular phthisis, but it is not often a very prominent affection, and is chiefly confined to the lower extremities. Sometimes, however, the body becomes universally anasarcous, especially in phthisis,—and very little can be effected for the effusion under such hopeless circumstances.

Dropsy from Disease of the Liver, [*Hepatic Dropsy.*]—This species of dropsy has been recognized from the very earliest periods of medicine of which any record remains, and to this most of the older histories of dropsy refer. The form which it assumes is chiefly that of ascites; and some peculiar symptoms attend its progress, which deserve consideration in its treatment. Dropsy takes place in the latter stages of most hepatic diseases; nor are we acquainted with any mode of detecting the precise nature of such diseases during life,—whether there is nutmeg liver, or simple enlargement of it, or tubercular disease,—excepting in the last instance, when the bulk of the organ has so far increased that a tolerably correct opinion may be formed by external examination.

Disease of the liver usually exists for a long time before effusion takes place, and its earliest symptoms are little more than those of simple functional dyspepsia. There is flatulence, uneasiness at the stomach after eating, and often some pain and tenderness in the right hypochondrium; and occasionally at a very early period the lower edge of this organ may be perceived harder, larger, and lower in the abdomen than is usual. There is a short dry cough occurring at times throughout the day, but more particularly on first rising in the morning, and the sputa are blackish and occasionally dotted with blood. The pain passes sometimes backwards under the blade-bone; at other times the muscles covering this bone, with the deltoid, become the seat of pain greatly resembling rheumatism, and not unfrequently mistaken for it. The urine is very red and deposits lithic acid, and the evacuations are usually, but not invariably, clay-coloured. In many instances sickness also is present, and a greater or less degree of jaundice. When this last symptom is united with those above enumerated, no doubt can remain that the liver is the seat of some important disease.

When the symptoms now mentioned have continued for some time, the ankles are perceived to swell at night a little, and the abdomen becomes somewhat fuller. The urine at the same time diminishes in quantity, the skin becomes dry and harsh, and the patient suffers from distressing thirst. The progress of the effusion from this period is very various; in some cases ascites is quickly formed, and the lower extremities become anasarcous throughout; in others the ascites is complete, while there is scarcely any œdema present; and in a third series of cases, the progress of both is very slow: in these last the ankles remain long slightly œdematous without any increase of effusion, and sometimes for two or three weeks together it entirely disappears, so that the patient fancies that the dropsical tendency is gone; again however it returns, and the dropsy becomes permanent. The duration of the disease is likewise various; for while in most cases several months elapse from the commencement of effusion till the death of the patient, in others the effusion takes place only a few days, or two or three weeks before death; and we have sometimes seen the abdomen become excessively distended three or four days only preceding dissolution.

As in dropsy from disease of the lungs, fresh symptoms are added as additional cavities become the seat of effusion; but neither the chest nor the ventricles of the brain so readily pour out fluid as when the dropsy commences with an affection of the heart or of the lungs. The dyspnœa which usually comes on in the latter stages of hepatic ascites, is chiefly to be referred to the protrusion of the diaphragm into the cavity of the chest, and it is seldom that any cerebral disturbance exists in these cases. Generally, indeed, hepatic patients preserve their intellectual powers to the last in a very extraordinary manner. We have sometimes however seen delirium come on in a few hours, or a day or two before death; but this is so usual in the closing scene of all chronic diseases, that it cannot be regarded as an essential part of the affection we are now describing. Under these circumstances the patient gradually wastes away; and death seems the natural result of a debility that had been continually increasing till the moment of dissolution.

Dropsy from Disease of the Spleen and Pancreas.—There are no general symptoms by which we can readily recognise these organs as the sources of effusion. With regard to the spleen, its enlargement usually long precedes the occurrence of dropsy; and the diagnosis, consequently, when the patient is seen early, can seldom be difficult. Dropsy from this cause often disappears; and we have known in one instance the effusion and the tumour vanish together, after the latter had existed for many months. The pancreas has not been much observed in dropsy, and we are not acquainted with any case of effusion that could be attributed to an affection of this organ.

Dropsy from Disease of the Kidneys [*Renal Dropsy*].—Many affections of these organs are capable of inducing effusion, and this is a common consequence when from any cause they are extensively diseased. The kidney is occasionally converted into a scrofulous mass; and we have met with cases, and several others are recorded, in which under such circumstances it formed a prominent tumour in the abdomen. A much less degree of disease is, however, sufficient to produce effusion. The form of dropsy under these circumstances is anasarca, and ascites does not usually take place till later in the disease. The œdema commences in the lower extremities, and in some instances which have come under our notice, the limb corresponding with the diseased kidney, where only one was affected, has swelled most; so that we are induced to believe that œdema in such cases is sometimes the consequence of pressure upon the ascending cava, or at least is aggravated by this pressure.

Dr. Bright has within these few years brought to the consideration of the medical world a peculiar change in the structure of the kidney, which he regards as the cause of dropsy, and the tendency to which change, or its actual occurrence, is indicated by the coagulability of the urine—[*Albuminaria.* (See KIDNEY, DISEASES OF THE)]. In these views he is joined by Drs. Christison and Gregory, the latter of whom has however shown that the peculiar alterations alluded to by Dr. Bright, and the presence of coagulable urine, often occur without dropsy. The peculiar nature of this change we shall intimate when we describe the morbid anatomy of dropsy.

Three forms of dropsy connected with disease of the kidney may be particularly traced in the cases recorded by the above-mentioned physicians:—the first commencing evidently with the respiratory or circulating organs, and united, either from the beginning or as the effusion proceeds, with disease of the kidney; the second, commencing with disease of the kidney, and secondarily affecting respiration and circulation; and a third in which the kidney is the only organ affected throughout. The first species differs little from that which we have already spoken of under the head of dropsy from disease of the lungs, excepting in the supervention of symptoms indicative of renal disease. These symptoms are sickness, vomiting, purging, pain in the loins, often united with coagulable urine; but this last may exist in a very great degree, and for a very long time, without any appreciable alteration in the structure of the kidney. The former symptoms exist in very various degrees, either alone or united, and are sometimes altogether absent.

The second form begins with anasarca only, which quickly becomes universal, and in a longer or shorter time, commonly within a few days, symptoms of inflammation of the lungs or pleuræ, or of both, supervene; and though this may be removed by appropriate treatment, it returns again, each time increasing the disorganization of these organs, and sometimes also extending to the pericardium, and giving rise to adhesions between its surfaces. The dropsy also is, at the commencement of the disease, often easily removable, but still it returns, till at length a few weeks or days before death it disappears altogether. In these cases, it is frequently only the anasarca and ascites that disappear, and the cavities of the chest are found after death to be full of effused fluid. In this as in anasarca from other causes, effusion may take place in the brain; and knowing the sympathy between the kidney and this organ, it is by no means surprising that this is no unusual occurrence.

The third is a much rarer occurrence than the two former. Dr. Bright has given one instance of this, in which no other symptom was present than extensive anasarca with coagulable urine, containing a considerable quantity of the red particles of the blood. The anasarca disappeared under the treatment which was adopted, but the patient died suddenly from inflammation and œdema of the glottis. Dissection appears to have proved that in this instance the kidney was in a state of excessive congestion, if we may not go so far as to call it inflammation.

A peculiarity in patients suffering under this dropsy is their extreme liability to be affected by calomel. Dr. Bright and Dr. Gregory have related instances illustrative of their proneness to severe salivation from very small quantities of mercury, and we have ourselves witnessed cases of the same kind.

Much importance is attached by Dr. Bright and the Edinburgh physicians to the coagulability of the urine, as indicating extensive change in the structure of the kidney,—much more, indeed, than it appears to us the evidence afforded is able to sustain. Dr. Wells has long ago shown that this symptom appeared and disappeared under circumstances in which it could not fairly be regarded as the consequence of organic disease. He saw it suddenly induced by the exhibition of mercury: he knew an individual in whom it appeared probable that the coagulability of the urine had existed for nine years: he also pointed out the frequency of its occurrence in that form of dropsy which succeeds scarlatina; and showed, likewise, that with the disappearance of the dropsy the kidneys ceased to pour out serum. Dr. Bright himself contends only for functional disease in the first instance, leading secondarily as in other cases to organic disease; although it must be confessed, from the great stress which he lays upon this one symptom, a cursory reader might easily mistake his meaning. Dr. Elliotson, also, is reported to maintain that the urine may strongly coagulate for a time without any change in the structure of the kidney.

We are, however, disposed to go even farther than this; and without denying that in some instances coagulable urine is the consequence of serious primary disease in the kidney, nevertheless to maintain,—that in many instances it is merely a symptom very remotely connected with organic alteration in the kidneys. As a secreting organ, the kidney is especially liable to be affected by the pabulum afforded it; and should the blood reach it in an imperfect state, whether in consequence of indigestion, imperfect change in the lungs, or inordinate action of the heart, or insufficient nervous influence, we may expect that its function will be impaired. Accordingly we see it deposit yellowish sediments in indigestion, lateritious sediments in febrile diseases, and phosphates after injury of the spine. Now in very many of the cases, perhaps in the majority, of dropsy with coagulable urine, the effusion is preceded by inflammatory symptoms of the organs of respiration; and in many there is disease of the heart. Considering the important changes that take place in the blood during its passage through the lungs, we can hardly be surprised that an affection of these organs should influence the secretion of urine; and again, while apoplexy is distinctly traceable to hypertrophy of the heart in some cases, it surely is not extraordinary that by this organ also the secretion of the urine should be modified. But we are not left only to theory on this point: the numerous cases in which the urine coagulates, already referred to, and in which organic disease cannot fairly be presumed to exist, confirm to a certain extent this view of the subject, while morbid anatomy still farther corroborates it. In two instances which we have lately had an opportunity of examining, where the urine had strongly coagulated during life, no disease whatever was observable in the kidney. To one of these we have already referred. The other occurred in a lady who had been suffering from pulmonary symptoms, and symptoms of disease of the heart, for nine months, when we first saw her. At this time the urine coagulated strongly, and continued to do so till the period of her death, three months afterwards. Yet, while the left lung, the pleura, and the heart, exhibited serious disease of long standing, and while the liver was also diseased, though in a slighter degree, — there was no appreciable change whatever in the substance of the kidneys. A small cyst containing a colourless fluid was seated on the superior convex portion of the left kidney, but did not in the slightest degree interfere with its structure. In this case there had never been any pain in the back.

The view we now contend for is by no means unimportant as a guide to practice; for the plan of treatment must necessarily be different, according as we consider the kidney primarily or secondarily affected. Should we find reason to believe that the respiratory organs are the earliest and principal sufferers, our chief attention must be paid to them. As a guide also to a correct prognosis, this view is most important; because, if the kidney is to be regarded as organically diseased in every case of coagulable urine, all such cases would be evidently hopeless, and little would remain for the physician but to smooth the path to a fatal termination.

The next question which presents itself connected with this state of the urine, is the condition of the system in which it exists. Dr. Blackall regarded it as inflammatory; Dr. Prout regarded it rather as proceeding from irritation than inflammation, (Prout on the Urinary Organs, first edit. p. 48); and other authors appear to have paid scarcely any attention to this part of the subject, excepting so far as stating that it could not be relied upon as a guide in practice. That it is at times connected with an inflammatory state of the kidneys, the following case, which occurred in our practice several years ago, abundantly proves.

A girl, twenty-three years of age, applied on the 11th of July, 1823, complaining of severe pain across the back, in the region of the kidneys, with shivering and frequent sickness. A short time before, the right foot had swelled; but at the time of her application this had subsided. Her urine was of a dark brown colour, depositing a thick precipitate upon the addition of tartarized antimony, and becoming of the consistency of melted butter by boiling. She made water very frequently, but very little at a time. She complained of pain in the pudenda. The catamenia were scanty, but regular to the period. She had had scarlet fever six months before, and her urine had been of the dark colour, now mentioned, ever since, but occasionally becoming a little clearer. This case was regarded as inflammation of the kidneys, and treated accordingly, and on the 21st of July, she was convalescent; the urine had then returned to a healthy state, being lighter in colour, and affording no coagulum upon boiling. On the other hand Dr. Blackall has given a case of dropsy after scarlatina, in which the urine remained coagulable after the effusion had disappeared, and regained a healthy state under the administration of cinchona. At the present time we have a case of dropsy with coagulable urine, in which the quantity of serum greatly diminished for a few days after taking sulphate of quinine.* Dr. Bright also remarks that occasionally we find anasarca even with coagulable urine so marked by debility that tonics and steel give decided relief.

Dr. Wells had seen the urine become coagulable after the exhibition of mercury, and this is now a well-known effect of mercury. Dr. Bostock observes that in a great majority of cases of persons in apparent health, serum may be detected in the urine by the appropriate tests, and that in his own person he had observed it to be increased to a considerable amount by the slightest causes. In a patient of the Birmingham Hospital, who had had anasarca connected with bronchitis, after both diseases had disappeared, and the urine, which had originally been coagulable, had recovered its healthy condition, it was found one day immediately after dinner to be rendered almost solid by heat, and the next morning the same means did not detect a single particle.

These few facts abundantly confirm the opinion of Dr. Prout, that taken alone "as a symptom, the albuminous urine does not, in the present state of our knowledge, indicate the use of any particular remedy or mode of treatment; but that, nevertheless, it is a symptom of which we ought always to be aware, since, taken in conjunction with the others, it may be occasionally useful in directing us to form a more correct judgment of the general nature of the disease."

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* The patient here alluded to was in the Birmingham Hospital, and died soon after the above was written. The body was examined, but there was no alteration in the structure of the kidneys. The cortical part was paler than usual, but retained its natural structure, and the tubuli were perfectly distinct. The kidneys were exhibited to several of the medical officers of the establishment, who all agreed that there was no change whatever of structure. The liver in this case was, if anything, smaller than natural, and externally had exactly the appearance of lung; internally it appeared as if it were pervaded by inspissated bile, and was firmer than natural. The peritoneal coat had contracted numerous adhesions with the diaphragm. The heart was remarkably small, the walls of the right cavity were very thin, while those of the left compared with the right were enormously thick. These were the only unusual appearances about the body. This man had been a spirit-drinker.

Albuminous urine appears to be much more intimately connected with anasarca than with ascites. Dr. Wells found it, in twenty-four cases out of thirty-seven, connected with anasarca; in fourteen cases of ascites previous to anasarca, there was no serum in the urine; and in eight cases of anasarca subsequent to ascites, the urine in all contained serum, and in one it was rendered solid by heat. Of the seven cases related by Dr. Christison, anasarca was the principal form of dropsy in six, and in the seventh only was the ascites a prominent symptom. Much the same proportion is observable in Dr. Gregory's cases; and in the twenty-three cases recorded by Dr. Bright, anasarca was the form of effusion in all.

We cannot dismiss this part of the subject without some observations on the composition of coagulable urine. Dr. Bright believed that the dark brown colour was frequently owing to the presence of the red globules of the blood, and in this opinion he is supported by Dr. Gregory. The case of inflammation which we have already given strongly supports this view, and there are few physicians probably who will doubt the possibility of its occurrence. This point therefore we may now leave: a much more important part remains, viz. to afford our readers the best means of investigating some of these points themselves.

All the writers referred to (and in numerous instances we have confirmed the fact by our own experience) state that coagulable urine has a much less specific gravity than healthy urine; and Dr. Gregory has given two tables containing the result of an equal number of trials with coagulable and with healthy urine. The average specific gravity in fifty cases was in healthy urine 1022·46, the highest being 1033, and the lowest 1005; while in the coagulable urine, the highest was 1023·5, and the lowest 1006·5.

With regard to the best means of detecting albumen when it exists in urine, we may observe that heat, while it is of readiest application, will generally be found sufficient. It is often advisable, however, to make use of re-agents, and of these corrosive sublimate is the most delicate. The nitric and muriatic acids are also employed for the same purpose, as is also the ferro-prussiate of potash, and alcohol. With respect to the effects of these latter re-agents, Drs. Gregory and Bostock are somewhat at issue. The former says that he never knew a case in which they caused a precipitate when heat had no effect, while Dr. Bostock observes, "I have also found certain states of the urine where heat had no effect, but where muriatic acid threw down a precipitate, and again where muriatic acid had no effect, but where the albumen was detected by the bichloride of mercury, or the ferro-prussiate of potash." All, therefore, that can be deduced is, that all these re-agents should be employed in succession in suspected urine, when the first fails to discover albumen.

Dropsy from Disease of the Uterus and Ovaries.—Many of the affections of the uterus, after they have existed long, give rise to dropsical effusions into the lower extremities. Sometimes this appears to be the result of pressure only upon the great vessels, when the uterus is either enlarged itself or contains a tumour of considerable size. At other times the effusion appears to be the result of the hemorrhage to which, under certain forms of disease, the uterus is peculiarly liable. This therefore is not fairly to be referred for its origin to organic disease of the uterus; the dropsy is simply the consequence of the hemorrhage, and hemorrhage from any other organ would give rise to similar results. With regard to the ovaries, we know that they are themselves the seat of those affections which are called encysted dropsies, and in this light they do not at present demand our consideration. But affections of the ovaries appear sometimes to produce real ascites, while they still present only the character of nearly solid tumours, and at the same time the lower extremities become œdematous. We have already mentioned our suspicion that ascites is sometimes a consequence of ovarian disease, subsequent to parturition, and we have met with cases of bronchitis in which ascites has taken place earlier than probably it would have done, had not ovarian disease existed previously.

Morbid Anatomy.—This naturally divides itself into two parts:—first, the morbid anatomy of the serous membranes and cellular tissue, which are the immediate sources of the effusion; and, secondly, the morbid changes of the various viscera, in consequence of which the serous membranes and the cellular tissue assume a dropsical disposition.

1. The most ordinary appearance in the serous membranes is thickening and opacity, which are more or less manifest in every serous membrane of the body. Thus in hydrocephalus, the lining of the ventricles, though seldom separable as a membrane, is evidently firmer and more condensed than natural; but the changes referred to are much more easily seen in the pleura, pericardium, and peritoneum. All these membranes become opaque or thickened; coagulable lymph is thrown out; and we not unfrequently find large layers of lymph converted into factitious membranes. Tacheron (Recherches Anatomico-Pathologiques, vol. iii. p. 196) says, "The pleura has been found thickened and covered with a layer of villous matter, oily to the touch, whitish, and similar to the intestines of the cow when converted into tripe." The same author has given an example of both pleura and the peritoneum becoming tuberculated. Dr. Ayre has related a case of ascites in which he found the peritoneum thickened and opaque, quite white, and having nearly the thickness of chamois leather. In the Quarterly Review of Foreign Medicine, a case is given of a woman who became dropsical after being brutally kicked by her husband: in thirteen years she was tapped 665 times, and on dissection the peritoneum was found cartilaginous and three lines thick.

So far as the serous membranes themselves are concerned, these appear to be the principal changes. With respect to the cellular tissue, Portal tells us that in dropsy it is more or less thickened, that the cells are dilated, and many converted into one, and that he had seen the intermuscular cellular tissue put on a cartilaginous appearance under such circumstances. (*Portal*, Des Hydropisies, tom. ii. p. 12.)

Morgagni relates a case of anasarca in which the tissue was thickened, and, as he says, the fluid, from the frequent intervention of the cellular layers, assumed the likeness of gelatine. Bichat observes that in prolonged cases of leucophlegmasia, the subcutaneous fluid is by degrees infiltrated through the prolongation of the areolæ of the skin, separates their fibres, and sometimes penetrates to the epidermis, which it bursts in different places, and the fluid escapes through the apertures which are thus made. (*Bichat*, Anatomie Générale, p. 689.) In the case above referred to, from Morgagni, the cuticle had been thus raised, but not burst, so as to form immense bladders, which were filled with water. (*Morgagni*, Ep. xxxviii. c. xxvi.) The cellular tissue itself is in such cases remarkably bleached.

This perhaps is the proper place for noticing the changes which occur in the absorbent vessels and veins. It has been often assumed that the former may be dilated and burst, but we know no cases which afford confirmation to such an opinion. That the absorbent vessels are more easily detected in dropsical bodies is true, but this probably is chiefly owing to the removal of the adipose substance of the system. Dr. Hodgkin, however, has lately rendered it probable that these vessels are in some way connected with effusion. He has related several cases of dropsy in which the absorbent glands, and especially those surrounding the great vessels, were enlarged and indurated. (Medical Gazette, January 21, 1832.) This enlargement appears to consist throughout of an uniform texture, rather the consequence of a general increase of the whole gland, than a new structure displacing the original one. It is simply an hypertrophy therefore of the glandular system. In illustration of this morbid growth, five cases are given, two in children, one nine and one ten years old; one in a man aged thirty, and two in persons of fifty years of age. In four of these cases the spleen was enlarged; and a fifth case of enlarged spleen with general induration of the absorbent glands is referred to, drawings of which were made by Dr. Carswell, and are contained in his collection.

In local anasarca the veins frequently exhibit peculiar appearances. Sometimes their cavities are completely obstructed by fibrinous clots, which have evidently formed during life. In other cases the internal membrane is thickened, red, and covered with coagulable lymph. Occasionally pus is found in their cavities.

Diseases of the arteries are often found in dropsy, and particularly aneurisms of the aorta. The late Mr. Freer believed that inflammation of the lining membrane was common. We are not aware that this observation has been confirmed, but we have seldom opened a patient dying with general dropsy who did not exhibit some disease of this membrane. This generally consists of scrofulous or bony deposits, with frequent ulceration; and we once saw the descending aorta beset with numerous incipient aneurisms, from this cause, a few of them being larger than a good sized pea.

2. The lungs are frequently found with the appearances consequent to bronchitis. The bronchial membrane is inflamed, and its texture thickened, sometimes even ulcerated. The cavities of the bronchi and air-cells are filled with a frothy fluid, and sometimes with pus. At other times we find the common results of pneumonia, congestion of the lungs, serous infiltration, hepatization, purulent infiltration, &c. When dropsy of the pleura has existed long, the lung is often so much compressed as to form a solid body, wholly or in part impervious to air.

Tubercles are not unusually discovered in dropsical patients, although no suspicion of tubercular phthisis may have existed during life.

The various organic alterations of the heart are also frequent in this disease, and may, doubtless, be regarded as the original cause of effusion. For a more minute account of these morbid changes we refer the reader to the articles on the diseases of this organ.

The liver exhibits an immense variety of appearances in dropsy. It is sometimes hard and scirrhous, many instances of which are given by Morgagni. (Epist. xxxviii.) Dr. Baillie says in many cases of ascites the liver is diseased, being hard and tuberculated; and in another place he has particularly described the kind of change which is here meant. The tubercles which are formed in this disease occupy the whole mass of the liver, are placed very near each other, and are of a roundish shape. They give an appearance everywhere of irregularity to its surface. When cut into, they are found to consist of a brownish or yellowish-white solid matter. They are sometimes of a very small size, so as not to be larger than the heads of large pins; but most frequently they are as large as small hard nuts, and sometimes larger. When the liver is thus tuberculated, it feels much harder to the touch than natural, and not uncommonly its lower edge is bent a little forwards. Its size, however, is not generally larger than in a healthy state, and sometimes Dr. Baillie thought it was smaller. If a section of the liver be made in this state, its vessels seem to have a smaller diameter than they have naturally; and it frequently happens that the liver is of a yellow colour from the bile being accumulated in its substance. The gall-bladder is generally contracted, and of a white colour, from its being empty. Dr. Baillie also mentions a peculiarly hard liver, which exhibits, when cut into, no peculiar structure, and is also accompanied by incipient ascites. This state of the liver has frequently fallen under our notice, and we have found it still only unusually firm when the ascites has been very considerable.

Dr. Bright has described an appearance of the liver, probably the more advanced stage of the last morbid structure, and which seems really to deserve the name of scirrhus. The substance of the liver is hardened throughout, and bands of thickened cellular membrane, like ligamentous matter, pervade every part: in some parts of the liver from which this description is drawn, it formed one-third of the whole structure. Although, when seen externally, the liver appeared tuberculous and knotty, yet when examined internally there were no tubercles. The liver is also sometimes studded with large white tubercles; and we have seen the structure of the organ so completely obscured by their accumulation, that it could scarcely be recognised. This disease, however, seldom gives rise to effusion till it has made very extensive progress. The weight of the liver in such cases is often very great: in a patient whom we examined last year, it amounted to eleven pounds.

The changes now enumerated form indeed but a small part of the modifications to which this organ is liable, and which are found to give rise to effusion. The observation of Dr. Bright, however, that those changes in the structure of the liver by which the branches of the vena portæ are compressed more frequently give rise to dropsy than any of the circumscribed changes, (as tubercles of various kinds, and hydatids occurring imbedded in their substance,) is perfectly accordant with our own experience; and the observation we have just made respecting the period of effusion in tubercular disease of the organ, drawn as that observation is from numerous facts which have fallen under our notice, is an additional confirmation.

The colour of even what is called a healthy liver is exceedingly various, and hence, from colour alone, it is not easy to draw any positive conclusions. Sometimes, however, the variation is so decided that we cannot hesitate to pronounce the structure diseased. The most remarkable of these changes is that which has been termed the *nutmeg* liver, and this term more completely explains the appearance than any lengthened description can do. Sometimes the whole liver is much lighter than usual; at others it is yellow, and appears to be filled with inspissated bile; and Dr. Bostock has rendered it probable that this is actually the case, for in a liver of this kind submitted to his examination, he inferred from numerous experiments that it contained cholesterine, the substance which forms the basis of biliary calculi. In a liver which we examined within these few days, the colour externally was that of hepatized lung, and it might easily have been mistaken for this organ so far as the colour was concerned. The interior was very dark, yet we could scarcely say that the structure was diseased. [See Liver, Diseases of the.]

The spleen is also frequently found in a diseased state in dropsy. It is sometimes much harder than natural, and at the same time considerably enlarged. It will occasionally attain an enormous bulk, forming a very prominent tumour in the abdomen, and after continuing some time, giving rise to effusion, by which the tumid spleen is subsequently concealed. The structure of the spleen does not in such cases appear altered, but is only firmer and more compact, still retaining its natural colour and granulated appearance. Sometimes this organ is covered with small white cartilaginous bodies, probably tubercles, as we once found them in a man whose lungs were studded with similar particles; and Dr. Hodgkin has related a case in which they seem to have pervaded the substance of the organ. In this instance the spleen was at least nine inches long, five broad, and proportionably thick: its structure consisted of an almost infinite number of small white globules, which appeared to arise from deposits in the cellular tissue of the organ.

The pancreas is seldom diseased in dropsy; we have sometimes thought it much harder than natural, but on cutting into it it has invariably exhibited a natural structure.

The kidneys are subject to various diseases, and very different morbid structures are exhibited in them in cases of dropsy. Dr. Bright thinks that his investigations will authorise three varieties *generally* attended by albuminous urine; — "In the first a state of degeneracy exists, which, from its appearance, might be regarded as marking little more than simple debility of the organ" (anæmia). "In this case the kidney loses its usual firmness, becomes of a yellow mottled appearance externally; and when a section is made, nearly the same yellow colour, tinged with grey, is seen to pervade the whole of the cortical part, and the tubular portions are of a lighter colour than natural. The size of the kidney is not materially altered, nor is there any obvious morbid deposit." This state of the kidney is well known as the consequence of dram-drinking, but it certainly is not confined to the victims of intemperance. It is frequently found in patients who have suffered from tedious and exhausting disease; and Dr. Bright himself states that he had observed it in a case of diarrhœa and phthisis, and of ovarian tumour. We have observed it in a woman who died from disease of the heart, and in whose lungs there were softened tubercles, none of which had been discharged. In this instance the urine did not afford the slightest coagulation by heat. In the most advanced stage of this disease Dr. Bright thinks that there is a more decided alteration of structure, and that some portions are consolidated so as to admit of very partial circulation; in which state the surface has a somewhat tuberculated appearance, the projections being paler than the rest, and at this period the urine is coagulable.

The second form is one in which the whole cortical part is converted into a granulated texture, and where there appears to be a copious morbid interstitial deposit of an opaque white substance. In its earliest stage this only produces externally an increase of the natural mottled appearance, or sometimes that of fine sand sprinkled more abundantly on some parts than others. The same appearance is slightly observable internally on making a longitudinal section. After the disease has continued some time, the deposited matter becomes more abundant, and innumerable specks of no definite form are observed on its surface. The cortical part exhibits, on being cut into, a similar appearance. Later in the disease, the granulated state begins to show itself externally in frequent slight uneven projections on its surface, and the kidney is rather larger than natural.

In the third form the kidney is quite rough and scabrous to the touch externally, and rises in numerous small projections, yellow, red, and purplish. The organ is often inclined to be lobulated, and on making an incision, the texture is found approaching to cartilaginous hardness. The tubular portions are observed to be drawn nearer to the surface, and it appears like a contraction of every part of the organ, with less interstitial deposit than in the last variety.

Dr. Bright also mentions two other conditions of the kidneys, in which coagulation of the urine is sometimes observable. One of these consists in a preternatural softness of the organ; the other in the blocking up of the tubular structure by small portions of a white deposit, bearing the appearance of small concretions. In the former, a corresponding loss of firmness has been observable in the heart, liver, and spleen; and in the latter, the cortical portion has been firmer than usual, and the tubuli have assumed a waved direction.

These are by no means the only diseases of the kidney that give rise to or are attended by dropsy. It is sometimes scrofulous. We have seen it converted into a steatomatous tumour so large that it formed a prominent tumour in the abdomen. In another case the right kidney was five or six times its natural size, soft, and divided into lobules. On opening it, it was found full of scrofulous matter, which occupied the whole of the cortical part and the interstices of the tubuli, which were scarcely at all traceable. The left kidney equalled the right in size, but was less diseased. The cortical substance was changed into a granulated fatty substance, presenting much the appearance of the liver under some circumstances. The tubuli were in this instance quite distinct. In this case, which is copied from notes taken in 1826, the urine had come away stillatim, and the patient had suffered very much from excoriation of the pudenda. She never complained of any particular pain till six weeks before her death, when she became anasarcous. The symptoms then agreed with those of Dr. Bright's and Dr. Gregory's cases. From the urine during the whole period coming away stillatim, this secretion was not particularly examined. We have particularly mentioned this case because it illustrates the remark of Dr. Gregory, that the persons in whom he found the morbid alterations of the kidney, were either those who had led irregular lives, or who presented the usual character of the strumous diathesis. Again, in a case which we examined a few days ago, the left kidney contained several calculi; and its structure, though much wasted, was remarkably healthy in appearance, while the right kidney was pale, and the tubuli were very indistinct in consequence of an interstitial deposit of a whitish substance.

These, probably, are only a few of the deviations from health which occur in the kidney, and which give rise to or accompany dropsy. With regard to any of these changes being necessarily connected with albuminous urine, enough has been shown above to prove that at present the subject requires additional investigation. We have found albuminous urine to a very considerable extent, without any corresponding alteration in the structure of the kidney; and we have related one instance of Dr. Bright's first variety, in which the urine did not coagulate. It cannot, however, be considered improbable that this phenomenon is connected with some peculiar condition of the organ, and that, when long continued, it will lead to some peculiar morbid alteration of structure. But what this condition or this alteration may be, must still be regarded sub judice; and we should mislead our readers in no slight degree if we called upon them to believe that anything further in this matter has yet been discovered, than a more frequent coincidence between coagulable urine and disease of the kidney than had been previously suspected. This coincidence, though frequent, is not invariable; nor are the symptoms which are reported to indicate it more to be relied upon. [See Kidney, Diseases of the].

Prognosis. — The prognosis in dropsy must naturally vary much according to its origin, its combination with organic disease, its duration, and the debility of the individuals who are the subjects of it.

Acute dropsies, cæteris paribus, are more curable than chronic, and idiopathic are more curable than secondary dropsies. With regard to acute dropsies our judgment must be greatly guided by the concomitant circumstances. If there be any vital organ seriously affected, as the lungs or the heart, our chance of removing the effusion will be governed greatly by the control we may be able to obtain over the original disease. Thus, if anasarca succeed bronchitis, a permanent recovery from the dropsy cannot be expected without the disappearance of the bronchitis. It will indeed sometimes happen, as we have mentioned in a previous part of this article, that effusion will disappear a short time before death; but this clearly is no cure of the secondary disease. In healthy constitutions, which have been uninjured by irregular habits of living, the acute dropsy will, under proper treatment, usually terminate favourably; but in those who have been weakened by drinking or other irregularities, or who are originally of debilitated constitutions, we can seldom venture to predict recovery.

With regard to secondary dropsy, we may state that those arising from disease of the heart usually admit of removal, but the disappearance of the effusion is seldom permanent. Nevertheless, longer or shorter intervals of ease are afforded; and, under cautious treatment, months, and even years may elapse between the first occurrence of effusion and the fatal termination. The same remark to a certain degree holds good of that species of dropsy which accompanies disease of the lungs, but it is certainly less curable than the former species. The effusion which succeeds hepatic disorders is almost always fatal, and by no means affords a chance of cure in an equal degree with the two former modifications. There are, however, some cases of ascites connected with enlargement of the liver, in which the effusion will disappear repeatedly under the use of diuretics, and in a few instances we have known a considerable time elapse before it has returned. That which succeeds or is accompanied with extensive disease of the kidney seems absolutely incurable when the renal disturbance has produced any extensive change of structure; but the symptoms of this change are by no means at present satisfactorily ascertained.

Treatment. — In the treatment of dropsy, as in every other disease which falls under the care of the physician, certain general principles are first to be considered; and, secondly, the circumstances by which these principles are more or less modified.

It has already been stated that dropsies are sthenic or asthenic, or in different periods of their progress that they partake of both conditions—at one time the sthenic, at another the asthenic predominating. To this point, then, attention must first be paid, and an antiphlogistic or a contrary regimen pursued accordingly.

Should the effusion have arisen suddenly, and should local inflammation be present, whether of the lungs or any other organ, bleeding must by all means be recurred to; and it must be carried far enough to affect the system, to reduce the pulse, produce faintness, or relieve the immediate inflammatory symptoms.

The bleeding may be repeated should the inflammation continue, and should the strength of the patient permit. But even when this is much reduced, and venesection can scarcely be justified, local bleeding may be advantageously employed, and in all such cases cupping is much more efficacious than leeches. The glasses should be applied as near as may be possible to the affected organ, and to the part of the organ which is most implicated. Accordingly, in disorders of the lungs, the blood should be drawn from the region of the chest; and if, which will frequently occur, one part of the organ is particularly affected, the glasses should be applied opposite to it. The same remark holds equally good in dropsy connected with inflammation of the pleura. In this case the chest should always be examined without covering, for by its dilatation, contraction, &c., much additional assistance is afforded to the diagnosis. Next to bleeding, counter-irritants are indicated in all those cases in which there are local affections, and it may be necessary to continue these for a considerable time. Indeed, in all chronic disorders, if counter-irritation be advisable at all, it is advisable to persist in it, either till the disease for which it is employed has disappeared, or till the strength of the patient seems to suffer from its effects. Whoever has examined a dropsical patient when pleuritis has been present, must have remarked the presence of factitious membranes of very different ages, and in comparing them with the previous symptoms he will usually be able to fix upon precise periods at which some of them were first formed. A little further reflection will lead him to the conclusion that at no time had the tendency to pleuritic inflammation been completely overcome, and although, at particular stages, evident and very severe exacerbations had taken place, yet that through the whole disease the inflammatory action had more or less persisted. Under such circumstances, reason clearly points out one course, viz., to continue the remedy while the slightest trace of inflammation remains. In inflammation of the pleura, (perhaps of serous membranes generally,) this is particularly necessary, for it is not always painful, and may proceed a great way without exciting surprise. And it is this point that appears to us most important in that species of dropsy to which Dr. Bright has assigned the morbid state of the kidney for its origin. We have already expressed our doubts whether in the majority of such cases the inflammation of the serous membrane be not the primary disease; at any rate it is frequently concomitant, and in no slight degree accelerates a fatal termination. Under such circumstances it is to the local inflammation and not the effusion that attention must be paid; if the former continue, the disappearance of the latter will be of no avail. Bleeding is not only called for in dropsy when local inflammatory symptoms are present; a general state of plethora equally demands it. Our chief dependence for an accurate diagnosis in this case is the full hard pulse, and in great measure also the history of the patient. We cannot, however, too strongly inculcate the necessity of care in bleeding individuals of irregular habits, and who have indulged excessively in drinking, especially spirit-drinking, or in any other debilitating vice. Whatever may be their appearance, or however hard and firm their pulse, such persons ill bear extensive sanguineous depletion; they sink rapidly afterwards into a low typhoid state, without the possibility of rousing the system to healthy and energetic action.

Of the two principal modes of overcoming inflammation, bleeding and counter-irritation, we have perhaps for this place said enough. Of internal remedies, the two most powerful unquestionably are the antimonium tartarizatum, and calomel in combination with opium. The former, to be really serviceable, should be administered in the doses recommended by the Italian physicians, and thus given, its efficacy in inflammation is most extraordinary. Nor is its effect merely felt in depressing the inflammatory action; it acts upon the bowels and upon the skin, and thus, not unfrequently, by promoting the functions of these organs, but especially of the last, it favours even directly the removal of the effusion. The principal inconvenience which is experienced from this medicine is the nausea and sickness which it induces, particularly after the first few doses. This, however, in most cases soon disappears, and the patient is able to take from one to three or even four grains at a dose without the slightest nausea. It will indeed occasionally happen that an individual cannot obtain what has been well termed *the tolerance* of the medicine; this, however, is so rare a case that it does not contradict the general position. Calomel and opium have been long known as peculiarly useful in those inflammations which throw out plastic lymph, such as iritis, cynanche laryngea, &c. These, however, are by no means the only forms of inflammation in which calomel and opium may be advantageously substituted for venesection or any other mode of bloodletting. Whenever the strength of the patient is too much reduced to admit of farther sanguineous depletion, while still the inflammatory symptoms continue unsubdued, this combination may be usefully employed. It should be given as frequently as every three hours, and according to the age of the patient the dose may be proportioned from two to four grains of calomel, with from half a grain to two grains of opium, every time. It may be continued till the mouth becomes slightly affected, but it will be seldom advisable to carry it farther than this. What has been now said merely refers to the subduing of any inflammation which may be present, which may give rise to or accompany the dropsical effusion. But to these we may often add diuretics or purgatives. Of the different articles which are employed for this purpose we shall speak more particularly in a subsequent part of this article. We here only intiby Dr. Fowler, as high as one hundred and eighty drops at night, and one hundred in the morning.

With the exception of abstaining from mercury, it does not seem necessary to lay down any other plan than what has now been referred to, when the disease of the liver amounts to change of structure. It ought, however, to be always kept in mind, that when the liver is tuberculous, or we have reason to believe that it is affected with hydatids, mercury may weaken the patient, but can have no effect upon the disease. How far under such circumstances it may be advisable to try iodine, or the muriate of lime, may be very properly a subject of consideration. In a case of apparent simple enlargement of the liver, in a girl of twelve years of age, but unconnected with dropsy, we certainly derived great advantage from employing the former, and under similar circumstances, connected with effusion, we should certainly be inclined to afford it a trial.

Treatment of Dropsy connected with Disease of the Kidney.—Dr. Bright, who has most attended to this subject, appears to lay the principal stress upon the supertartrate of potash; but in this, as in every other modification of dropsy, reference must first be had to general principles. We have already stated our opinions at some length respecting the signs by which the affections of these organs may be ascertained. When, therefore, we feel convinced that the kidneys are diseased, the same rules which have been laid down for the treatment of other local disorders will apply here, and local depletion with counter-irritation must be as proper in the one case as in the other. At the same time we confess that on this point we have not experience for our guide, so far as this particular organ is concerned. We may, however, mention a fact that has been related to us on good authority connected with diabetes mellitus, and which has some analogy with the disease now under consideration. The medical man to whom a patient with this disease applied, and from whose urine he had collected a considerable quantity of sugar by evaporation, rubbed in the unguentum antimonium tartarizatum over the loins; and while the irritation was kept up, the sugar entirely disappeared from the urine. Other symptoms, however, supervened, which compelled him to suspend the ointment, and the sugar was again found in this fluid. The supertartrate of potash has the same effect in this dropsy as when disease of the lungs or pleura is present. We are sorry to say that we have little more to add on this subject, as it is one to which at present little attention has been paid, and respecting which our actual knowledge is any thing but precise. We would, therefore, most strongly inculcate the observance of general principles in its treatment, till farther investigations shall have clearly demonstrated those peculiar modifications of practice which may be demanded by the particular organ.

[Observers have differed in regard to the propriety of administering diuretics in the dropsy occasioned by the disease of the kidney, described by Dr. Bright. By most, they have been considered unadvisable, especially in the early periods; but they are advised by M. Rayer, who prefers cochlearia armoracia. Notwithstanding the argument of Dr. Christison (On *Granular Degeneration of the Kidneys*, Edinb. 1839, and Philad. 1839, and art. Granular Diseases of the Kidney, in Tweedie's *Library of Practical Medicine*, Amer. edit. iii. 271: Philad. 1842) that an agent which increases the secretion of an organ may not add to existing disease in that organ, diuretics must be considered equivocal remedies; and, upon the whole, Dr. Christison is desirous of so regarding them in the disease under consideration; but he is of opinion, that the "dread of an evil influence from them over the primary disease has led several estimable authorities to forbid their employment likewise in all secondary affections, in some of which no other remedies are so promptly efficacious."]

We may here very properly terminate our consideration of particular forms of dropsy. They, however, by no means exhaust the subject; and careful observation would probably find signs no less marked in effusion occurring after the disease of other organs, and a consequent propriety of modifying the treatment. What we have already said will, we trust, afford a somewhat clearer view of the principles upon which dropsy ought to be treated, than has yet been published. It will show that certain general principles apply to all, but that these are more or less modified according to particular circumstances, and the organs which give rise to effusion in the first instance, or become involved in the course of the disease. There is nothing empirical or irrational in this treatment. Dropsy is not (as it is too often regarded by men even highly intelligent and much engaged in practice) the consequence either of debility alone or inflammation alone; it is neither always a sthenic nor asthenic state of the system in which it occurs; it may be one or the other, or the one may alternate with the other. Since we find that different organs are the original causes of effusion, the treatment of the local diseases is not to be neglected in the great anxiety to remove the dropsy. Neither is effusion to be neglected; but we are to use different remedies according to the organs which are affected. Some of these we have endeavoured to point out; in doing so we do not pretend to be free from error; but the road is opened for others, to pursue a similar line of observation. If this is carefully followed, we do not question but that a few years will add a mass of information respecting the peculiar power of medicines in this disease, which may go far to diminish its present ill repute, as one of the opprobria medicinæ.

Of the particular remedies employed in Dropsy.—We should not consider that we completed the subject of the treatment of dropsy, did we not offer a more complete record than we have yet done of the various medicines which have been proposed as specifics in this disease. We may comprehend these under the various heads of purgatives, diuretics, emetics, sudorifics, tonics, frictions, scarification, acupuncturation, paracentesis. The operation of some of these we have already discussed, and here, therefore, we shall do no more than enumerate them.

Purgatives.—The principal of these are the croton *tiglium*, from which the croton oil is expressed, and in which form alone we know the remedy in this country. The dose is a single drop, and this will operate in many instances most violently, producing within half an hour sickness, vomiting, and profuse alvine discharges. Dr. Good recommends the alcoholic solution first proposed by Dr. Nimmo, but we have never found the oil do any real mischief. There are individuals upon whom it will not act at all, or who require four or five drops to ensure the operation. With such idiosyncrasies the oil must of course be given in the larger dose.

Elaterium is also given with the same intent. We have mentioned under the article Anasarca, the form we prefer, viz. two grains of elaterium (or half a grain of *elatin*) combined with a scruple of the extract of gentian, and divided into four pills, one to be given every hour till free evacuations are procured.

The common elder and the dwarf elder (sambucus *nigra*, sambucus *ebulus*) have formerly enjoyed a high reputation as hydragogues; and the former is particularly recommended by Sydenham. Every part of these plants is emetic and purgative, but the most potent is the inner bark, which may be taken in powder or infusion. The dose of the former is said by Dr. A. T. Thomson to vary from five grains to half a drachm; we have, however, no personal experience upon the subject, nor can we say to which species of dropsy it is most applicable. If the remark of Sydenham be correct, that it acts equally upon the kidneys and bowels, we should expect it to be particularly serviceable in effusion connected with disease of the liver, when it is thought advisable to unload the system quickly, as experience seems to prove that ascites (and this is the form which usually accompanies hepatic disorder) usually yields more completely to diuretics than to purgatives.

Rhamnus *catharticus*, or common buckthorn, is another hydragogue highly praised by Sydenham, but which, like the elder bark, has gone out of fashion. Sydenham employed it in syrup, and states that it removes the effusion without disturbing the circulation, or rendering the urine higher coloured, as other purgatives are accustomed to do; but that it has the inconvenience of inducing excessive thirst. The dose of the recent berries is one scruple, that of the dried berries a drachm. The dose of the syrup prepared according to the London Pharmacopœia is from half an ounce to an ounce, the patient drinking freely at the same time of demulcent fluids.

Helleborus *niger*, or black hellebore, has also been used as a hydragogue; and Avicenna,—no mean authority so far as the mere action of remedies is concerned,—observes that he had seen more wonderful effects from it than from any other remedy—"but it will not always equally work wonders." The dose as a hydragogue is from ten grains to a scruple. In the employment of black hellebore much care is necessary that the extract be fresh, for, by keeping, it appears very soon to lose its medicinal qualities. The dose above-mentioned may be repeated at the end of six or eight hours if no operation shall have ensued; but in practice the utmost caution is necessary that the peculiar poisonous effects do not follow. In some individuals the smallest dose induces inconceivable anxiety. In the few instances where this has occurred in our own experience, the individuals were known to be incapable of bearing the mildest narcotic medicines, from the intolerable distress which always followed their exhibition.

Many other purgatives, as gamboge, jalap, scammony, neutral salts, have at various times been in vogue for the cure of dropsy, but it scarcely seems necessary to speak of them here more particularly. They all in great measure act in a similar manner, viz. by producing free watery discharges, and thus stimulating the absorbent function. The supertartrate of potash is rather a mild aperient than a purgative, and occasionally acts also most powerfully as a diuretic. It is remarked, however, by Dr. Ferriar, that it sometimes "neither increases urine nor stool, yet it cures." Its use in dropsy was, we believe, first particularly pointed out in this country by Dr. Home, and in his reports he has related twenty cases in which it was employed. We collect generally from them that it was most beneficial where there was an inflammatory action present in the system, and where there was no actual organic disease. At the same time it appears in some instances to have been serviceable where the liver was deranged. Its action is chiefly that of an aperient, producing profuse watery evacuations, without exciting thirst or feverishness. Dr. Thomson states the dose as a hydragogue to be from four drachms to six drachms, in an electuary. Dr. Mason Good says that in order to ensure its aperient action, it ought never to be given in less than ounce doses; but our experience by no means corresponds with this. We have frequently succeeded by giving only drachm doses three or four times a day: after the second day profuse watery evacuations often follow to such an extent that we are obliged to suspend the medicine. In the intervals the milder tonics may be advantageously employed. (See Cathartics).

Diuretics.—Digitalis holds the first place, in modern times, in this class of medicines; but as, in the course of this article, we have already mentioned the circumstances which render it most appropriate in dropsy, we shall only refer the reader for a more particular account of this drug to the article Diuretics.

The squill is certainly a very powerful diuretic, but its powers are much increased by uniting it with other diuretics, particularly the neutral salts. In some cases, where the inflammatory action is at all high, its operation is greatly favoured by small doses of blue pill administered in such a manner as slightly to affect the mouth. Dr. Blackall observes, that it is much to be depended upon, when, with an oppression of the chest, the urine is scanty, high-coloured, and without serum. How far this last remark is perfectly correct may be questioned; but that it is highly serviceable when the urine is high coloured, is perfectly in accordance with our own experience.

The attention of British practitioners was first called to the diuretic properties of the pyrola *umbellata* by Dr. W. Somerville, and they are so well attested, that we cannot but regret that more attention has not been paid to it. It is a native of North America, and belongs to the natural family of Ericeæ. The latest account is that of Dr. Bigelow, professor of Materia Medica and Botany in Harvard University, in the United States. "In a number of dropsical cases," says this gentleman, as quoted by Messrs. Churchill and Stephenson, "when first given, it made a distinct and evident impression on the disease, communicating an increased activity to the absorbents, followed by a great augmentation of the excretion from the kidneys. The benefit, however, with me, has been in most instances temporary, and it was found better to omit the medicine for a time, and to resume it afresh, than to continue it until the system had become insensible to its stimulus. After suspending it for a week or two, the same distinct operation took place on returning to its use, as had been manifested in the first instance. It proved in almost every instance an acceptable medicine to the patient, and was preferred, both for its sensible qualities and its effects on the stomach, to other diuretics and alteratives which had been prescribed." The paper of Dr. Somerville, which is contained in the fifth volume of the Medico-Chirurgical Transactions, is valuable from the post-mortem examination of Sir James Craig, to whom the plant had afforded very important benefit. In this instance the liver was studded with innumerable tubercles, the peritoneum throughout was thickened, and the intestines were glued together with coagulable lymph.* The lungs on the left side were sound, but compressed on the right side by three pints of water. The pericardium contained six ounces of water, and the heart was somewhat larger than usual. The history of this case abundantly proves that the original malady was in the liver. According to Dr. Somerville, the virtues of this plant do not reside in any volatile principle, and he found consequently that a decoction acted much more energetically than an infusion. In order to make this decoction, an ounce of the dried plant, including the root, stalks, and leaves, is cut into small pieces, and macerated twelve hours in two pints of cold water, and then boiled till it yields one pint of strained liquor. Mr. Carter found that thirty-four pounds avoirdupois of the recent herb produced four pounds of extract, which had the same properties with the decoction. Five scruples of this extract in pills or in solution may be given in twenty-four hours.

The spartium *scoparium* or common broom, the leontodon *taraxacum* or dandelion, the apium *petroselinum* or common parsley, the juniperus *communis*, and the colchicum *autumnale*, all possess considerable diuretic powers, and may frequently be united with some of those above mentioned, with much advantage. The meadow-saffron is perhaps the most powerful of all these, and we have succeeded with it in conjunction with mercurials, in acting upon the kidneys in hepatic disease when no other remedy had any effect. The spiritus colchici ammoniatus of the London Pharmacopœia is the preparation which we have chiefly relied upon, given in half-drachm doses three times a day, with a blue pill night and morning, and sometimes mercurial frictions over the abdomen being added.

In the 57th number of the Journal Hebdomadaire, for October, 1831, M. Lemasson has given a detailed account of the employment of the bark of the root of the chiococca racemosa anguifoga, or snow-berry tree, belonging to the natural family of the Rubiaceæ. This bark furnishes a bitter principle, crystallizable in delicate needles, without smell, of a bitter and rather an astringent taste, soluble in water, very soluble in alcohol, especially when warm, and reddening the tincture of turnsole; in this principle all the peculiar medical properties reside. This remedy is said by M. Lemasson to be chiefly applicable to atonic dropsies. A decoction of the bark is made by macerating two drachms of the bark in eight ounces of water, then boiling for ten minutes, and straining the liquor off, which is divided into two doses, and the second dose is taken two hours after the first. The cases related by M. Lemasson are all connected with great general debility of the system. One was a case of chronic bronchitis with slight dilatation of the heart, and in this patient the feebleness was very considerable. Two were the consequence of syphilis and mercurial courses, to which universal anasarca succeeded, but without any particular visceral disease. In one patient affected with dilatation of the right cavities of the heart, the exhibition of the bark was preceded by bleeding. The effect in all was an improvement of the appetite, and a great increase in the flow of urine. The medicine is administered as above-mentioned in two four-ounce doses, with an interval of two hours between the first and second dose; when this affects the kidneys, they continue their action for several days, and the medicine is not again exhibited till the urine diminishes. In the first case which was related, it was given on the 18th of June, on the 20th of the same month, and not again till the 5th of July, after which it was not repeated. In the second case it was only given twice. On the 22d of May, and on the 29th, both terminated successfully, and the medicine had a similar effect of increasing the appetite and the flow of urine together.

Emetics.—These have been recommended by some authors, and cases have been given, in which they have succeeded when other remedies had failed. We have ourselves no experience of their effect in this disease, and they appear to be banished from modern practice. We shall content ourselves therefore with this intimation.

Sudorifics.—These are unquestionably in some cases highly useful, more particularly however when disease of the lungs is present. The vapour-bath has occasionally been successful in such cases. The celebrated Dampier cured himself by covering himself all over with sand, heated by the sun, in California, for an hour, after which "he was carried to his bed and well covered with clothes, where he fell into a profuse sweat, after which he recovered daily." The compound ipecacuanha powder has in this way been successful, and we have seen ascites attended with liver disease removed by it, though the patient died soon after, from the original malady.

Tonics.—Every species of dropsy may in some part of its course require the exhibition of tonics, for a state of debility easily follows depletion, however necessary it may have been; and it has not unfrequently happened that a patient has been cured of dropsy, and died of the weakness induced by the remedies. To obviate this, appears to have been the object of the celebrated electuary of Dover, which is a combination of scammony, sulphuret of iron, and crude mercury. Of this formula Dr. Blackall says, that "it has certainly performed many cures, and there is so much debility in the disease, that the addition of tonics to purgatives, never indifferent, is particularly desirable here, where it can be made with safety." Steel and bark are the principal tonic remedies that have been used in dropsy, and we consider the ferrum tartarizatum to be the best preparation of the former, as it unites a diuretic with its tonic properties. We have usually given it in combination with infusum calumbæ, and particularly in those asthenic dropsies in which the heart or lungs are diseased. In the asthenic dropsy consequent to chronic bronchitis, united with counter-irritation of the chest, it will sometimes alone remove the effusion. The sulphate of quinine is given with the same intention, and in weak and scrofulous habits it seems preferable to the preparations of steel. Dr. Blackall prefers bark also in the debility consequent to dropsy after an acute disease. In the exhibition of these tonics the utmost care is necessary that they are not given in an inflammatory state of the system, nor while the tendency to inflammation remains; but when by bleeding, digitalis, and other evacuants, the effusion has nearly disappeared, and the urine recovered its natural state and quantity, tonics will complete the cure, and secure the patient from a relapse.

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* As, however, he had been frequently tapped, this last appearance was probably a consequence of the operation, and not a part of the original disease.

The action of the remedies just mentioned is more distinctly known than that of the tonic pills of Bacher, and which we have noticed under the article ASCITES. More like cream of tartar than common tonics, these pills seem sometimes to be merely anti-hydropic, removing the effusion without inducing any increase in the urine or alvine evacuations. The dropsies in which we have found them most useful are those which occur in girls about the age of puberty, without manifest derangement of any particular organ, and we have observed them to be more useful in ascites than anasarca. The younger Bacher, in speaking of black hellebore, says that it is not applicable to cases in which the solids are firm, nor when the fibre is greatly relaxed and weakened, but when, with some degree of debility, the circulation is irregular, and determined to some particular organ. We may observe, however, that in many of the cases he has related, no such determination is indicated by the symptoms enumerated, and in our own practice they have seldom been of use, when there has been evidence of organic disease. The action of these pills, as we have already mentioned, is often imperceptible, but at other times they procure copious evacuations from the kidneys and bowels, and sometimes, according to Bacher, they cause profuse perspiration. The following is the formula of Bacher, as published by his son:—

℞ Extracti hellebori nigri,
Myrrhæ solutæ, aa, ℥i.
Cardui benedict. pulv. ʒiii℈i. M. s. a.
Fiat massa aere sicco exsiccanda, donec formandis pilulis apta sit. Singulæ ad grana sex.

Ten of these pills were given three times a day.

We have repeatedly cautioned medical practitioners against the danger which may ensue from the poisonous properties of the black hellebore, and here therefore we shall only inculcate extreme watchfulness whenever this remedy is exhibited.

It is probable that many other of the common mineral and vegetable tonics may be employed in asthenic dropsy, and it will always be advisable that the practitioner should, as far as possible, be provided with substitutes, as, from particular idiosyncrasies, individuals are sometimes incapable of taking what may in other respects be the most appropriate remedy.

[*Methodical compression*, where it can be employed, is often of decided service in promoting absorption; at other times, it is employed only as a support when the integuments are largely distended with the fluid of dropsy. Frequently, the benefits from compression are more apparent than real—the fluid being simply forced from the cellular membrane pressed upon by the bandage, and returning to its former position when the pressure is withdrawn.]

Friction.—Under the head of ASCITES, we have referred to a case in the 49th volume of the Philosophical Transactions, in which friction with oil effected a cure in an old case of ascites. We are unacquainted with the particular symptoms which more particularly indicate this remedy, but there certainly can be no objection to it in any case in which the abdomen is free from tenderness.

Blisters.—These sometimes afford great relief, and we have often had recourse to them in our own practice. They are not, however, always unattended with danger, and whenever they are applied, the surgeon ought to be requested to attend to their progress. We have more than once seen death hastened by the blistered surface becoming inflamed, and mortification ensuing.

Scarifications.—These are indeed the opprobria medicinæ. They afford relief from the pressure and weight of the effused fluid, but too often at the same time give rise to inflammation, gangrene, and death. Yet there may be cases in which the distension is so great and the distress so intense, that the operation may not only be justified, but may be demanded. Upon this head we would briefly remark, that in old and very debilitated persons they should seldom, perhaps we might more properly say, they should never be practised, and that in young persons in whom the reparative process is more readily set up, great attention should be paid to their appearance and progress. The mere presence of dropsy will make no difference as to the proper manner of treating the wounds; but if inflammation be present, or gangrene, the same local and general remedies must be recurred to, as if no effusion had existed; nor indeed is this only useful to the wounds; frequently when the fluid has escaped, the tonic and stimulating remedies which the surgical treatment has required, have prevented the return of the effusion.

Acupuncture.—This is only a milder manner than scarification, of effecting the mechanical escape of the fluid; and the remarks made upon the former are equally applicable to the present remedy. Evil consequences are perhaps less frequent, but still they do not unfrequently occur. (See Acupuncture.)

Paracentesis.—Of this operation we have spoken under the head of Ascites, nor does it appear to us necessary to add to the remarks which we have there made.

Diet.—The only point that remains to be noticed is that of diet, but upon this head, we do not feel called upon to make many remarks, nor should we indeed have mentioned it at all, had it not been for the vulgar opinion which formerly prevailed, that fluids ought not to be allowed to dropsical patients. Even this notice is perhaps quite unnecessary, as the error is, so far as we know, completely exploded. Sir Francis Milman first examined the question, and gave the most satisfactory evidence that the restriction from fluids was not only not beneficial, but was in many cases even injurious; and since his time, so much additional evidence has been obtained to the same purpose, that to allow dropsical patients as much fluid as they wish to drink, is becoming an axiom in the treatment of disease. It has been well ascertained that many diuretics only stimulate the kidneys in proportion to the quantity of liquid in which they are given.

With respect to the nicer question of food, it seems unnecessary to make any remark: this must be varied with the nature of the dropsy, and the symptoms by which it is attended; and whoever understands the meaning of a phlogistic and antiphlogistic regimen will know how to apply either of these, or to vary from one to the other, in the disease of which we have been treating, as circumstances may require.

John Darwall.

DYSENTERY.—This word is derived from the Greek word *δυσεντερία*, which is compounded of *δὺς* (*difficile*, *ægre*, *male*,) and *ἔντερον* (*intestinum*), and signifies that the intestines are morbidly affected. By Celsus the disease is named *tormina*, from one of its leading symptoms; and by Cælius Aurelianus *rheumatismus intestinorum cum ulcere*. Dr. Ballingall applies to it the not inappropriate appellation of *colonitis*. By certain French writers it is called *colitis* (colite), and in common language it is named *flux* or *bloody flux*, according as the intestinal discharges are free from blood or sanguinolent. It is placed as a genus in the class *pyrexiæ*, and order *profluvia* of Dr. Cullen; in the class *fluxus*, and order *alvifluxus*, of Sauvages; and, very correctly, in the class *hæmatica*, and order *phlogotica*, of Dr. Mason Good.

Division of the Disease.—Dysentery consists, in its early and acute stage, of inflammation of the mucous membrane of the intestines, especially of the colon and rectum. This inflammation, by implicating the other coats of the bowel, and by generating ulcers, may produce extensive and very intractable disorganization, giving rise to symptoms less acute than those of the early stage, but bearing a considerable resemblance to them. Hence it appears that there is a natural division of the disease into an acute and chronic form; the first consisting of inflammation, the second of its occasional effects, supervening on attacks of the acute disease, which have been imperfectly treated, or which our art has proved too feeble to subdue.

Various writers have proposed divisions of the acute stage into species, and complex arrangements of this kind are to be found in systematic works. From what has been stated respecting the nature of the disease, it will be manifest that any distinction between cases of uncomplicated dysentery must be principally founded either on the degree of inflammation, or the extent of intestine affected by it. The former circumstance unquestionably gives rise to various shades of discrepancy between different cases, but admits of no precise line of demarcation by which any assemblage of cases can be contradistinguished from others. The extent of bowel implicated in the disease constitutes a somewhat more important ground of distinction, for it is supposed that in the warmer regions a larger portion of intestine is affected with inflammation than in temperate climates; and that this circumstance, coupled with certain effects produced on the constitution by a high temperature, invests the disorder named by recent writers *tropical dysentery*, and by Savages, *dysenteria æquinoctialis*, with a peculiarity of character meriting special notice. It will hence appear that uncomplicated dysentery may be considered under two heads, the first comprising that form of the disease most frequently observed in temperate climates, whilst tropical dysentery is discussed under the second. It should be remarked, however, that though the distinction between the extremes of these varieties may be very manifest, intermediate degrees will be found, and such it has not unfrequently occurred to the writer of this article to observe in the south of Europe, which might be referred with almost equal propriety to either the one form or the other. Besides these varieties in the character of simple dysentery, its complications with other diseases require attention.

The following definition of dysentery will perhaps be found sufficiently precise:—Frequent mucous or muco-sanguinolent stools, pain in the abdomen, griping, and tenesmus, generally accompanied with pyrexia.

The uncomplicated dysentery of temperate climates.—Premising that many degrees of intensity are found in this affection, from the slight sporadic case in which the general health is but little deranged and no danger threatens life, to the wide-wasting epidemic which has proved the scourge of fleets and armies, we shall present a sketch of as mild a form as the disease is almost ever observed to wear. A case of this description may commence with feculent and liquid stools, and they may become subsequently mucous, with occasionally a slight admixture of blood; or, they may be of the latter character from the beginning. There is little if any fixed pain in the abdomen; but considerable griping previously to the patient's rising to the night-chair, with a peculiar sense of working or commotion in the bowels, often referred to the situation of the sigmoid flexure of the colon; there is generally some heat at the anus, but the sensation extending thence up the rectum is one rather of irksomeness than of heat, and it induces very distressing straining, constituting the affection called *tenesmus*; the dejections do not exceed seven or eight in the day, and after they have acquired the mucous or sanguinolent character, traces of feculent matter are occasionally perceptible in them. Dysury is rarely observed, dyspnœa never, though both of these morbid states are very general attendants of more severe cases of the disease; the appetite is generally impaired; the thirst is considerable; the tongue is sometimes furred, occasionally natural, and the pulse is little, if at all, quickened or affected with respect to its force. The mean duration of this slight form of the disease is from seven to eight days; it may be said to be never fatal, but it not unfrequently lays the foundation of chronic dysentery, and often leaves such a tenderness of the bowels as renders them more prone than before to morbid action from cold or other causes. We should presume that the inflammation in such a case as this was slight in degree, and limited to the rectum and inferior portion of the colon.

A more intense form of the disease than that which has just been described, will be found of frequent occurrence when dysentery is prevailing epidemically. This more severe disease may be preceded by diarrhœa, which we have observed to be a very general precursor of dysentery in whatever climate we have witnessed it; or it may occur without this premonitory symptom. Occasionally a well-marked rigor, followed speedily by febrile heat, introduces the disease; whilst, in other cases, the first symptom is pain in the bowels, to which the mucous stools characteristic of dysentery in a short time succeed. In many instances some slight derangement of the stomach and bowels, indicated by flatulency, costiveness, inappetency, nausea, and occasionally vomiting, is experienced for some days before the attack. When the disease is fully formed, the characteristic mucous or muco-sanguinolent stools are passed very frequently, with great pain, an extreme degree of straining, and a feeling as if the viscera themselves were about to be discharged. Feculent stools occasionally intervene between the dysenteric discharges, and pure blood is sometimes voided in considerable quantity, especially in an advanced stage of the disease. After the disorder has subsisted some days, it is not unusual for the patient to void portions of a substance resembling suet, tallow, or flesh. A sense of heat, or, as the patients express it, burning at the anus, extending thence up the rectum, and which becomes excessive when there is a call to empty the bowels, is much complained of. When fever has occurred from the commencement of the disease, it of course subsists throughout its progress; and in cases in which it has not existed from the first, it usually arises when the intestinal disorder has become so fully formed as we are now describing it to be. There is a warm skin; a hard, generally frequent and small pulse; the tongue is either covered with a white mucous coat, or it is dark and dry; there is great prostration of strength, and the urine is scanty, high-coloured, and is passed with pain and difficulty. The griping which precedes each evacuation is very distressing throughout the disease; but only in an advanced stage, and in a case which has held its course uninfluenced, at least beneficially, by treatment, is there much if any permanent pain in the abdomen. When it occurs, it is generally situated in the hypogastric region, and is increased by pressure. Its presence, especially if it is accompanied by fulness and distension of the abdomen, may be generally considered as a bad omen, as indicating that the inflammation has extended to the exterior tunic of the bowel. Dyspnœa is frequently observed to co-exist with the symptoms, denoting that the peritoneal surface of the intestines is affected. Throughout the disease there is loathing of all solid food, and the thirst is great, sometimes intense; and it is attended with this distressing circumstance to the patient, that in many cases everything which is taken to allay it produces tormina, and an instantaneous and irresistible impulse to go to stool.

Should no relief be afforded by the remedies employed, the prostration of strength becomes great; the pulse feeble, with coldness of the extremities; the tongue either furred and brown, or glazed, red, and aphthous; the discharges from the intestines are dark and offensive; the mind is low and desponding; hiccough is an occasional symptom, and death sometimes takes place in a period varying from a fortnight to three weeks from the commencement of the attack. But much more frequently, even in bad cases, some mitigation at least of symptoms is obtained, and the disease degenerates into a chronic form.

Restoration to health may be expected when there is diminution of pain in the abdomen, of tenesmus, and of the frequency of the discharges, and especially if, instead of the mucous or muco-sanguinolent dejections, the stools become natural. An abatement of the febrile symptoms and thirst, and a return of appetite, are favourable signs; but all favourable symptoms are to a certain extent fallacious, for after a truce of a few days we may discover that we have that insidious and slowly-wasting disease, chronic dysentery, to combat.

This description, which comprises the two extremes of the disease as it has fallen to our lot to observe it in Europe, is drawn from personal observation. For an account of dysentery as it occurs between the tropics, we must be indebted to the able men who have witnessed its ravages in those regions.

Tropical Dysentery.— The following is Sir G. Ballingall's description of tropical dysentery, or, as he very properly terms it, colonitis.

« The form of flux now under consideration commences in general with much of the appearance of a common diarrhœa; frequent and unseasonable calls to stool, with an irresistible inclination to strain over it. The evacuations are generally copious, of a fluid consistence, without any peculiar fœtor; sometimes streaked with blood, and at other times a small quantity of blood is voided in a separate form, unmixed with the fæcal matter. The pulse, in this stage of the disease, is seldom altered; the heat of the skin is not perceptibly increased, and the tongue is frequently but little changed in its appearance. There is always a great prostration of strength and depression of spirits; the former symptom being always strongly dwelt upon by the patient; the appetite is indifferent, and the thirst urgent. To these symptoms succeed a fixed pain in the hypogastrium, more or less acute; the pain extending to, and peculiarly urgent in, one or both ileac regions, and sometimes to be traced along the whole course of the colon, with a sense of fulness, tension, and tenderness upon pressure; and on applying the hand to the surface of the abdomen, a preternatural degree of heat is frequently perceptible in the integuments. The evacuations now become more frequent and less copious; they consist chiefly of blood and mucus, or are composed of a peculiar bloody serum, which has been very aptly compared to water in which beef has been washed or macerated. A suppression of urine and distressing tenesmus now become urgent symptoms; the indifference to solid food increases, while there is an uncontrollable desire for liquids, particularly cold water, which the patient prefers to any drink that may be offered to him, and from which he expresses his inability to refrain, though prepossessed with the idea of its being injurious. The tongue is now generally white and furred; sometimes, however, exhibiting a florid, smooth, and glassy appearance, with a tremulous motion when thrust out; the skin is either parching hot, so as to render it even painful to retain the hand in contact with it, or covered with profuse perspiration, insomuch that it may often be observed standing in large drops on the surface; the pulse is still frequently but little affected; sometimes, however, it assumes a febrile quickness, without any other remarkable feature; at other times it will be found without any increase of velocity, but full and bounding, with a peculiar thrilling sensation under the fingers. This state of the pulse, whenever it takes place, always denotes extreme danger, and shows that the disease is rapidly hurrying on to the final stage, in which the lassitude and dejection so conspicuous throughout its course are now converted into the utmost degree of anxiety, depression, and fear of death. The patient generally shows an inclination to dwell upon symptoms which to a spectator would appear of minor importance. He evinces the greatest reluctance to part with his medical attendant, though fully sensible how unavailing the efforts of medicine are likely to prove. The discharges by stool, which are frequently involuntary, are now accompanied with the most intolerable fœtor; they are frequently mixed with shreds of membrane, and quantities of purulent matter; a protrusion of the gut, forming a complete procidentia ani, takes place; and cases are not wanting where a portion of the inner coat of the intestines amounting to some inches has been thrown off in a state of mortification." (Observations on Dysentery, p. 49.) It is needless to say what must be the result of such a case as this, unless it is efficiently succoured in an early stage.

Diagnosis.—The only diseases with which dysentery can possibly be confounded are cholera, hemorrhoidal flux, and diarrhœa.

The rapidity of the march of cholera, compared with the long duration of dysentery, is alone an important ground of distinction between them. Cholera occasionally ceases in twenty-four hours, and perhaps never lasts beyond a week; whilst the mean duration of dysentery is probably about a fortnight, and many cases endure for months. Vomiting is a uniform attendant of cholera, and is seldom observed in dysentery; the purging, during a considerable part of the course of dysentery, is mucous or muco-sanguinolent, whilst its prevailing character in cholera is bilious. Tenesmus is a most distressing symptom of dysentery, but in cholera it is generally absent. In cholera the alvine discharges are copious, and are passed with violence; the very reverse is the case in dysentery, and the former disease is attended with spasms of the extremities, which are not perceived in the latter.

The tumours at the margin of the anus; the blood flowing from the commencement of the disease unmixed with mucus; the comparative absence of tenesmus; the freedom from abdominal pain; and the solid nature of the feculent discharges, which are observed in hemorrhoids, will secure us from confounding this disease with dysentery.

The distinction between dysentery and diarrhœa is easily drawn, in the more advanced stage of the former disease, from the mucous and sanguinolent condition of the alvine discharges; but the testimony of the writer must be added to that of Sir James M'Grigor and many others in proof of its extreme difficulty, in many cases, in an early stage. If it is then to be found at all, it must be sought in the character of the prevailing epidemic rather than in that of any individual case submitted to our observation. We believe that the pathological condition in dysentery, and in cases of severe diarrhœa, is in its nature the same; but that the inflammation of the lining of the digestive canal is more intense and enduring in the former than in the latter disease. In both cases, the first effect of this inflammation is the rapid expulsion of the ordinary contents of the intestinal canal; but the inflammation existing in dysentery remains after the canal is entirely emptied, and gives rise to those secretions from the lining membrane which constitute the discharges characteristic of the disease. In certain cases, those unpreceded by diarrhœa, the site of the inflammation in the lower part of the bowels seems to have the effect of retaining the natural contents of the canal, and of causing, from the first, evacuations consisting merely of matters secreted from the bowels.

From the description given of epidemic choleric fever, (see CHOLERA,) it will be manifest that from the moment the choleric stage is fully formed, no confusion can arise between this disease and dysentery. The spasms, serous discharges, and early collapse of the former disease, are extremely distinctive. But in the incipient stage of the two disorders, some difficulty might be experienced, which would, however, be dispelled by a reference to the character of the prevailing epidemic.

In this view of the diagnosis of intestinal affections attended with increased discharge, it is impossible not to be struck with the strong relation which in their rudimental stage they generally bear to each other—a relation which cannot but lead to the suspicion, that, however widely different in character and danger they may be when fully formed, the primary pathological condition is, in all, if not identical, certainly closely analogous.

Chronic Dysentery.—This may be considered as almost a more distressing termination of the acute form than death itself, for recoveries from it are rare, and it is fatal after an amount of protracted suffering which is extreme. The fever which attended the acute form subsides, and a temporary recruiting of strength and appetite is experienced, but this truce from distress proves deceptive. The patient occasionally feels sharp pains of the bowels, with frequent stools, consisting of food apparently little changed by the process of digestion, mixed with slight streaks of blood: these symptoms may subside, and continue to recur at intervals, either from some manifest imprudence in regimen, or without any assignable cause, until extensive disorganization of the intestine takes place. The stools are then mucous and bloody, sometimes mixed with purulent matter; or such dejections as these alternate with discharges of sanies, or of offensive, ill-digested fæces, the number of evacuations varying from three or four to seven or eight in the day. The abdomen at the same time feels full and hard, without being very painful on pressure; the urine is high-coloured, and is passed with pain. The patient, when in bed, lies on his side, with the body much curved, and the lower limbs in the position of extreme flexion on the abdomen, so as to relax its muscles as much as possible. The pulse is feeble, intermitting, and generally slow, excepting towards evening, when some degree of fever occurs. The tongue is often bright and glossy; the skin is cold, sallow, dry and rough; the lips appear exanguious; emaciation proceeds rapidly; the feet and legs become œdematous, and ascites occasionally takes place; the patient sometimes becomes jaundiced; and finally, after the lapse of weeks or months, he sinks from irritation and exhaustion.

The odour of persons suffering under this disease is peculiar, and the same may be occasionally observed in the acute disease: no description could convey an idea of it to one who had not experienced it, but if once recognized, it cannot be forgotten; it is very offensive, and at the same time acid. It is independent of that of the matter ejected from the bowels.

Acute dysentery occasionally leaves the bowels in a condition less decidedly morbid than that just described, and one from which the patient generally recovers, but after a considerable lapse of time, perhaps of years. This condition is indicated by attacks of diarrhœa, commonly of the lienteric character, recurring at intervals of three or four weeks, and lasting for a few days; during the attacks the dysenteric odour is perceptible about the person of the patient.

Complications of Dysentery.—This disease is found combined with fevers, that is, instead of the pyrexia symptomatic of the local affection, some form of idiopathic fever exists in conjunction with dysentery; and if the fever is a contagious one, the two may be communicable together. Knowing as we do the proclivity of fevers to affect the intestinal lining, it cannot be matter of surprise that the large intestines should be occasionally the seat of such affection. There are other diseases, too, with which it is occasionally found combined.

The complication with typhus occurs under the operation of debilitating causes, such as want of food; and where numbers of persons being accumulated in a space proportionately small, proper ventilation and cleanliness are impracticable.

From these causes it has frequently proved more fatal to the garrisons of besieged towns than the assaults of the enemy. It is characterized by a remarkable stupor, resembling that of a drunken man; by headach, vertigo, and delirium; the eyes are dull and very sensible of the impression of light; on some day between the fourth and the sixth day, a miliary or petechial eruption often appears on the neck, breast, and arms; the tongue, teeth, and gums are covered with dark sordes, and the pulse is frequent and small, or, when the danger is imminent, intermitting. The dejections are frequent, scanty, composed of mucus mixed with dark-coloured blood, and of an extreme fœtor; the urine is high-coloured, as if stained with blood; nasal hemorrhage is not unfrequent, but it does not prove critical; the usual colic pains of dysentery are severe during the first four or five days; then they abate, and are again increased about the ninth or eleventh day, when a diarrhœal discharge comes on which frequently destroys the patient rapidly. When the case is fatal, death generally occurs from the ninth to the thirteenth day, but sometimes as early as from the third to the seventh.

Dysentery occasionally complicates the early stage of intermittent fever, and in this stage it may be found either during the paroxysm only, or, which is much more frequently the case, as a permanent disease associated with the ague. But its existence at the commencement of intermittents is very rare in comparison with its occurrence at a more advanced period, when disorganization of the liver and other abdominal viscera has resulted from the long continuance of the disease. Its supervention in the advanced stage of ague constitutes a melancholy complication, and is very frequently accompanied or followed by general dropsy; the patient lingering in much suffering until released by death. (See INTERMITTENT FEVER.)

Pathological researches have proved the complication with disease of the liver to be much less frequent than was supposed; yet there seems no doubt that, in a form of dysentery occasionally met with in warm climates, there is such a complication. The affection of the bowels commences in the form of diarrhœa; the stools are variously coloured, black, green, or deep yellow; they are preceded by considerable griping, felt principally about the umbilicus; they are frothy, accompanied by much flatus, and cause considerable scalding or excoriation about the anus. After a few days they become white and mucous, with an occasional admixture of imperfectly digested aliment. Throughout the disease, there is inappetency, with nausea, intense thirst, a yellow fur on the tongue, great oppression in the epigastrium, and a frequent pulse. It is a slow disease, lasting for weeks or months; and in its progress great emaciation, hiccup, and bilious vomiting, are superadded to the other symptoms. This form of dysentery, which is sometimes called hepatic flux, may terminate in health, in incurable disease of the bowels, or in abscess of the liver.

The following graphic sketch of a form of dysentery more intense than the foregoing is drawn by an experienced observer of the diseases of warm climates. According to the views of the writer, which are most probably accurate, it should be referred to the complication of dysentery with hepatic affection which we are at present describing.

"The patient is at first languid, and loses at the same time his appetite and hilarity of mind. Sometimes he complains of pain in the region of the liver, increased by pressure, and in some degree relieved by the expulsion of flatus from the stomach; but this pain is very trifling, or at least much more slight than might be expected from the condition of the liver as discovered after death. The presence of this symptom denotes the true character of the disease; but in many cases it is entirely wanting, and hence the greater obscurity. In many cases the most acute observer can discover no sign of bad health, but a white tongue and a pulse more frequent than usual.

"Matters remain in this state during a period varying from four to eight days, and the inexperienced practitioner apprehends little danger; but in this respect he is deceived; for an insidious fever depresses the patient by almost imperceptible degrees, till the actual symptoms of dysentery, namely, tenesmus and very frequent alvine discharges, display themselves with great violence. These symptoms are accompanied by ardent fever, delirium, oleaginous sweat, febrile anxiety, and urgent thirst, whilst the tongue is covered with a yellow fur, which is converted towards the close of the disease into a permanent dark crust. A large quantity of green, bilious, and sanguineous matter flows from the bowels, and finally convinces the medical attendant that the morbid condition of the liver and bile is the exciting cause of the flux. There is not much pain in the bowels in this stage of the disease; but the tenesmus is most distressing, and occasionally protrudes a portion of the rectum from the anus. Subsultus tendinum, hiccup, and cold sweats take place; and, unless relief is afforded before the disease reaches this stage, death speedily ensues." (De Dysenteriâ Regionum Calidarum. Archibaldo Robertson Auctore. Edin. 1817).

Pathological Appearances.—These vary according to the period of death and the nature of the case. If dysentery prove fatal in an early stage, the appearances are those of inflammation simply, or of inflammation and gangrene of the mucous membrane of the large intestines, with few or no traces of ulceration. If at a more advanced period, the other coats of the bowels are found to participate in the disease, and numerous and extensive ulcers are discovered. In inflammation, the external appearance of the bowel is healthy; but, on opening it, portions of its mucous membrane throughout the whole extent of the colon and rectum, and occasionally some part of the small intestines, are found of a bright red or brownish colour, and sensibly elevated above the level of the more healthy parts which are interposed between them. These inflamed portions are sometimes covered with a puriform, sanguineous, or sanious secretion, which gives them the appearance of ulceration; but if this is scraped off with the back of a scalpel, and the part is washed, the surface is found unbroken. False membrane is sometimes found deposited on the mucous coat. Dr. O'Brien describes it as occurring both in the large and small intestines, but as being most frequent and remarkable in the colon and rectum. In some cases, he informs us, it occurred in patches, but in others the mucous membrane was covered by a uniform layer of white lymph. (Transactions of King and Queen's Colleges, vol. v.) Gangrene is denoted by blackness or lividity, and morbid softness of the membrane, the muscular coat occasionally partaking of the softness; and in some instances by vesicles full of a fetid fluid.

In cases which have terminated fatally in a more chronic stage, there is thickening of the tunics of the intestine, and the bowel is contracted in diameter and ulcerated. The ulcers are diffuse or follicular. The former may be of the size of a sixpence or a shilling, or an extensive portion of the membrane may be in a state of almost continued ulceration, the diseased surface being varied by portions in a state of red fungous elevation, running irregularly over it, and separating the ulcerated spaces from each other. The follicular ulcers are of the size of split peas; their concavity is lined with pus, and their edge is surrounded by a red circle. The follicles are occasionally found in a state of inflammation, having a tubercular appearance, compared to small-pox. The ulceration occasionally perforates the coats of the intestine so as to allow its contents to escape into the cavity of the abdomen. This accident and its consequences deserve separate consideration. (See Perforation.) Adhesions of the peritoneal surface to the adjacent viscera, and serous effusion into the cavity of the abdomen from the extension of inflammation to the exterior tunic of the intestines, are not unusual occurrences.

Other viscera, beside the bowels, are occasionally found to show traces of disease. The mesenteric glands are sometimes enlarged and inflamed, and the omentum is described by Dr. Jackson as being in some cases dry and shrivelled, in others gangrenous, and occasionally forming a new and fleshy-looking substance, which confines the intestine in such a manner as to obstruct its canal. (A Sketch of Febrile Diseases, by Robert Jackson, M.D., Stockton and London, 1817, p. 439.) The liver has been supposed to be generally affected in dysentery, and it is occasionally found small and indurated or enlarged, and at the same time of a firmer consistence than natural, or an abscess has been found in it in that form of the disease called hepatic flux; but pathological researches have proved that changes in its structure are much less frequent than was imagined, and by no means essential to dysentery. Even in cases of this disease in which this organ is functionally affected during life, or in which researches after death show that its structure has undergone a change, (and the instances where this latter occurrence is discovered bear a very small proportion indeed to the whole amount of examples of fatal dysentery;) there is great reason to think that the irritation is rather propagated from the intestinal canal to the liver, than that the reverse order of causation takes place. There is no organ of the body of which the influence in generating disease has been so much overrated by medical men as the liver, occasionally perhaps from mere carelessness, but too often, we apprehend, from a not very creditable wish to run with the current of popular opinion, which throughout Great Britain and her dependences is strangely favourable to hepatic and bilious doctrines.

Causes.—Dysentery is generally most prevalent during the latter end of summer and autumn, when the alterations of temperature are sudden, and especially when there is a considerable discrepancy between the heat of the day and night; but there is no season of the year in which it is not found occasionally to make its attacks, provided the body be exposed to the cause peculiarly favourable to its production, cold or, chill after comparative warmth. It is much more prevalent in the warmer latitudes than in temperate climates; probably in some degree from the circumstance, that in the former situation the heat of the day is followed by great comparative cold at night, the chilling effect of which is aided by the heavy dews which are so general in the warmer regions of the earth. The operation of the same cause is manifested in the case of soldiers, who are frequently attacked in numbers after a night-encampment or bivouac on damp ground.

Unwholesome food, the abuse of spirituous liquors, and the drinking of bad wine, bring on attacks of the disease in climates and situations where it prevails; but indulgence in fruit, which is often assigned as its cause, does not appear to have such an effect.

Malaria is supposed to be a cause of dysentery, and there is reason to think the supposition correct. The disease occurs in the climates, situations, and seasons favourable to the production of periodic fevers; it is occasionally combined with them, and appears to succeed or supplant them, as though it were owing to a continuance of the operation of the febrific cause, modified in its nature or influenced in its effect by extrinsic circumstances. The analogy between dysentery and other forms of bowel complaints and such fevers has struck the eye of observers from Sydenham to Jackson. It is difficult to assign to the first-mentioned causes, cold and bad diet, and to malaria, their respective share in the production of the disease. It is probable that sporadic cases are frequently owing to the former exclusively, and that they may co-operate in producing attacks of the disease when it is prevailing epidemically; for instance, malaria having been applied, exposure to cold or dietetic errors may immediately bring on an attack.

The discrepancy of testimony as to the contagious nature of this disease is extreme; but were the question one which the preponderance of great names could decide, it would probably be answered in the affirmative. So general was the belief in its contagious nature some years ago, that contagious pyrexia is inserted among the characteristics of the disease in Cullen's Nosology, as if it were an acknowledged incontrovertible doctrine. But in the present day we believe there is scarcely a medical man of much experience in the disease who believes it to be contagious; and the writer has never seen a single case which he had the least reason to attribute to such a cause. The conflict of opinion on this point is perhaps to be explained by certain authors having seen many cases of dysentery complicated with typhus, and by their having ascribed to the disease, generally, that which is true only of one of its complications.

Treatment of Acute Dysentery.—The nature of the disease being ascertained, the practice to be pursued becomes sufficiently obvious. Bloodletting naturally presents itself as one means of subduing the inflammation; and if the constitution sympathises with the local affection, so that there is general fever, with a warm skin and a frequent and sharp pulse, blood should be taken freely from the arm. We should not rely upon general bleeding as the sole mode of depletion in the disease, for experience teaches us that the inflammation of mucous membranes is less amenable to this remedy than that of most tissues; but it should be followed by local bleeding by means of leeches; and in the milder order of cases this may altogether supersede general depletion. Twenty or thirty leeches should be applied along the course of the colon, or to any point of the abdomen where pain is felt, the parts being subsequently covered with a hot poultice. The repetition of leeches must of course depend upon the intensity and duration of the disease, and the degree of relief afforded by the first application. Should griping, purging, and particularly fixed abdominal pain continue, they may be repeated on the following day, or each succeeding day, to the third or fourth time, if the circumstances mentioned indicate the propriety of the repetition; their number in the later applications being regulated by the necessity of the case and the strength of the patient. It should be remarked, however, that the first application, if vigorous, frequently affords so much relief, that, by the aid of internal medicine, the disorder proceeds thenceforward very steadily to recovery. Hot fomentations and the warm bath will be found serviceable after the bleeding, and subsequently the abdomen may be blistered with benefit.

Purgatives are generally administered; and, during a considerable period when the retention of feculent matter in the cells of the colon was erroneously supposed to constitute the very essence of the disease, they were principally depended upon by some practitioners for its cure; and though the more correct views at present entertained may seem to forbid their employment, experience teaches us that to unload the bowels, when requisite, with gentle laxatives, is not only safe but beneficial. Were the writer to digress into a question of general therapeutics, but one connected with the present subject, he would remark that though laxatives are found prejudicial in neuralgic irritation of the intestinal canal, he has never observed injurious effects from their moderate and judicious employment in inflammation of its mucous lining; and that he has detected the most extensive lesions of this membrane, where the practitioner had rigidly abstained from them. It is desirable, however, that the abuses which heretofore existed, regarding their employment in dysentery, should not be resuscitated, and on this account it appears advisable to specify the sole circumstances under which they should be administered in this disease, and the precautions this administration requires.

In every case of dysentery, the first remedial measure should be directed to subduing the essential disease, the intestinal inflammation; the primary and paramount means, therefore, are the general or local bleeding, or both, as the circumstances of the case may require. In that form of the disease which is unpreceded by diarrhœa, a dose of castor-oil, sufficient to expel the matters lodged in the intestines, may be given after a little respite from suffering has been obtained by bleeding; and should its operation be tardy, it may be accelerated by a mild emollient enema. In that more frequent form of the disease which has diarrhœa as a precursory symptom, purgatives should by no means be employed early; but in any form of dysentery, should a considerable period have elapsed without a feculent discharge, a mild laxative will be advisable, for the retained matters are generally in a morbid condition, and can scarcely fail to be a greater source of irritation to the inflamed membrane than the operation of a gentle laxative. The repetition of medicine of this kind will of course depend on the circumstances of the case; should the alvine discharges become feculent and copious, it need not be repeated. No more proper laxative can be selected than the oleum ricini, aided in its operation by a mild, tepid, and emollient enema. Some practitioners think favourably of a solution of neutral salts with which a proportion of tartarized antimony is combined; but it seems doubtful whether the irritating effect of the salt on the intestines would not counterbalance the benefit likely to accrue from the diaphoretic action of the antimony.

Mercury is so powerful a subsidiary of general and local bleeding in the cure of inflammation, that we should naturally expect benefit from it in this disease; and experience proves its prudent employment to be of great service. It might be objected to on the same ground as purgatives, the dread of an irritating effect from it on the inflamed intestine; but the result of its employment, our only safe guide, shows the apprehension to be erroneous, provided the medicine be properly administered. It is a remedy more generally applicable to dysentery in warm latitudes than in this country; but if employed with prudence, and merely as subsidiary to the general or local bleeding, or both, advantage will be derived from it wheresoever the disease may be prevailing. A grain or a grain and a half of calomel, combined with from five to ten grains of Dover's powder, or half a grain of opium; or five grains of hydrargyrus cum cretâ, likewise combined with the opiate; may in this country be administered at intervals of four hours, the period being lengthened when the symptoms begin to abate. It is not necessary to excite ptyalism, although this is a contingency from which no evil result need be apprehended, provided the medical attendant be sufficiently watchful of the effect of the remedy to prevent its being excessive. In warmer climates, the same dose of mercury, combined with a smaller proportion of Dover's powder, or a grain of ipecacuanha, may be given every hour or two till some effect is produced on the disease or the system. In our Indian settlements the practice is much bolder than this, calomel being administered in doses of a scruple. Mr. Annesley gives such a dose nightly, followed by an oily or a saline purgative in the morning, till the dejections become natural and healthy, (Sketches of the Diseases of India, p. 417;) and calomel in such doses is a familiar remedy with British physicians in tropical climates.

Diaphoretic medicines are employed by many medical men in dysentery. The cerated glass of antimony, which was a favourite remedy with Sir John Pringle and others, probably owed great part of its influence over the disease to its power of exciting perspiration; and the combination which has already been mentioned, that of a mercurial preparation with Dover's powder, perhaps derives part of its very great utility from the same property. Ipecacuanha alone is a valuable medicine of this class. It may be given in large doses in the form of pills without exciting vomiting, as in the manner recommended by Mr. Twining in the Calcutta Transactions. By combining it with extract of gentian he exhibits as much as six grains, which he repeats at intervals; and, as he assures us, with an excellent effect. A decoction of three drachms of the root, boiled in a quart of water down to a pint, administered in portions of three or four ounces, as an enema, and repeated once or twice in the day, we have often found to have the effect of allaying irritation and tenesmus, and to be generally beneficial. The same medicine is frequently combined with calomel, or other mercurial preparations, with considerable improvement of the efficacy of both. Emetics are favourites with some practitioners, but the benefit to be derived from them is much more certainly and easily attained by nauseating or diaphoretic doses of ipecacuanha.

Tenesmus is frequently a distressing symptom. Of course effectual relief can be afforded only by the general process for subduing the disease; but it may be allayed by anodyne enemata, of which a solution of three or four grains of opium in a small quantity, not more than two ounces, of starch mucilage, constitutes a very good one. Dr. Abercrombie recommends injections of lime-water, at first diluted with milk or thin arrow-root, with the addition of an opiate. It should be impressed on the minds of junior practitioners that enemata administered with the view of allaying tenesmus should be small, for this affection is aggravated by distending the lower portion of the intestinal canal with bulky fluids. Mild emollient clysters have already been recommended as adjuvants to the oleum ricini when there is retention of feculent matter in the intestines; but it should be understood, that their employment in these cases is admissible only when the irritation of the inferior portion of the canal is not extreme. We have met with instances in which even the introduction of the pipe could not be borne. In such cases as these, tenesmus and irritation may be allayed by opium, Dover's powder, a dose of laudanum, or by opiates combined with infusion of cusparia or balsam of copaiba, administered by the mouth.

Dr. Cheyne, whose practice in the dysentery of this country has been very extensive, thinks highly of the power of opium in its cure, and gives the following summary of his experience of its efficacy and that of other remedies. The mode of treatment he found most generally useful was bloodletting, followed by calomel and opium, and this by balsam of copaiba and farinaceous diet; and he says, "were the same cases again to be placed under my care, I would not hesitate to give opium in doses of four or five grains, as it was the opium chiefly that seemed to arrest the progress of the inflammation; and whatever in such a case procured respite to the patient from agony, sometimes proved of permanent benefit." (Dublin Hospital Reports, vol. iii.) This testimony, proceeding from such a quarter, should have great weight. The concluding clause contains a truth of much importance, and one applicable to many diseases besides dysentery.

[Dr. Christison expresses the belief, that the cure of epidemic dysentery may often be effected by opium alone, begun early and given boldly. In one epidemic, it was prescribed at once in the dose of one, two, or three grains every six, four, or three hours, according to the urgency of the symptoms, until signs of its narcotic action began to display themselves; and in this way sometimes twenty and even thirty grains were given in the first twenty-four hours. In several cases, where the treatment was commenced not later than the close of the second day, the force of the disease was at once completely broken, and the only remedies needed afterwards were the continuance of the opium in diminished doses, and restricting the patient to pulpy solids as diet. The writer has often seen the excellent effects of opium in this as well as in other inflammations, given in sedative doses; but caution has to be used that it be not pushed too far.]

Swathing the abdomen with flannel, so applied as not to press painfully, is useful as a means of keeping the temperature uniform. Should abdominal pain require relief, hot fomentations may be frequently and freely resorted to. If the anus be inflamed or excoriated, it should be bathed with goulard water; and it may be protected from the acrimony of the discharges by being anointed with unguentum cetacei, or wax and oil.

The diet throughout the disease should be mild and light, consisting of arrow-root, milk, simply, or with gum acacia dissolved in it, rice or barley-water, and mucilaginous and bland matters of this description; they should be given in small quantities at a time, and the whole amount of what is taken should be small.

Treatment of Chronic Dysentery. — Our indications here are much more perplexed, and our difficulties much greater, than in the acute form of the disease. That intestinal ulcers occasionally heal has been proved by Dr. Troilet, (Journal Général de Médecine); and Dr. Latham, in his account of the disease which prevailed in the Penitentiary at Milbank, has given an excellent description of intestinal ulcers in the progress of reparation: hence we should not utterly despair of success in this very intractable malady. As in most diseases which are but little amenable to our art, the remedies proposed are very various. Those which deserve the most confidence are small doses of hydrargyrum cum cretâ or calomel with Dover's powder, or the same mercurial preparations with opium and ipecacuan; lime-water; vegetable astringents and bitters, as kino, catechu, cusparia, quassia and logwood; nitric acid; opium; balsam of copaiba or tolu; or various combinations of these remedies, as a strong decoction of cusparia with nitric acid and laudanum, recommended by Dr. Abercrombie. The late Dr. Jackson, whose experience of this form of disease was very extensive, placed much reliance on small general bleedings, repeated at intervals of a week; but in a disease attended with so much debility as this, very moderate local bleeding from the integuments of the abdomen, and the application of blisters to the same parts, appear to be safer methods of accomplishing the object to be attained. Moderately stimulating and oleaginous frictions of the abdomen, the part being subsequently swathed with flannel, are occasionally found useful; and the warm salt-water bath is soothing to the patient, and generally beneficial to the disease. Powdered charcoal, combined with powder of ipecacuan and rhubarb, has been found advantageous; and Dr. Abercrombie speaks favourably of a combination of the same substance with Dover's powder. The writer has found considerable temporary benefit in this distressing affection from the sulphate of copper, administered in the manner recommended by Dr. Granville in various chronic affections of the bowels. It is given in doses of half a grain with an equal quantity of opium; and is gradually increased, if necessary, sometimes to the extent of three grains, with half-a-grain or a grain of opium three times a day. Where there is reason to suppose that the lower part of the intestinal canal is the seat of ulceration, various injections are employed with advantage. A weak solution of acetate of lead or white vitriol has the effect of allaying irritation; whilst a solution of blue vitriol, or one of corrosive sublimate in lime-water, excites foul and sluggish ulcers to healthy action, and in some cases has appeared to aid materially in effecting a permanent cure. These injections should not consist of more than two or three ounces of fluid, for great irritation is produced under the circumstances mentioned by distending the canal by large enemata.

[The various remedies recommended in diarrhœa (q. v.) are equally appropriate in the affection under consideration.]

The diet, throughout the disease, should consist of the mildest and most bland farinaceous food, taken in small quantity, solid animal food and all stimulating matters being rigidly forbidden. Solid food, in any considerable quantity, must be injurious as a more mechanical irritant in that condition of the intestines which beyond a doubt exists in chronic dysentery; whilst liquid freely taken excites griping, passes rapidly through the bowels, and must tend to disturb that reparatory process which it should be our object to encourage. If the disease have commenced in a district where dysentery is endemic, change of air is a remedy of first importance, and one without which all other means will often prove nugatory. A sea voyage has frequently proved very advantageous.

The treatment to be adopted in dysentery, *complicated with idiopathic fevers*, will be gathered from the rules contained in this article, and in the articles on continued and periodic fever. The combination with liver disease, the *hepatic flux* of Ballingall, and others, requires mercurial treatment by means of blue-pill, calomel and opium, or inunction, till ptyalism is induced; and this, unless the exhaustion of the patient forbid it, is to be kept up till the discharges assume a healthy appearance. Laxatives are occasionally requisite, and of these castor-oil is the most proper. The warm-bath, sudorifics, blisters, and bandaging the abdomen with flannel, are as important as in the treatment of the uncomplicated disease; and should the tenesmus be distressing, it may be allayed by any of the forms of anodyne enemata recommended in that disorder.

JOSEPH BROWN.

DYSMENORRHŒA, (from δὺς, *ægre; μῆνες, menses; ῥέω, fluo;*) *painful* or *difficult menstruation.*—This disease is important from its occasional extreme obstinacy; from the great suffering which it produces, and from the contrariety of opinion which prevails as to its nature, and the treatment required for its relief. In healthy menstruation there is often no warning whatever of the period; more generally there is some degree of discomfort, consisting of a sensation of weight and fulness about the pelvis, with a bearing down and aching of the thighs, but usually the suffering is so slight as not to call for medical aid; in dysmenorrhœa, however, the menstrual period is accompanied with such acute pain and suffering, and is looked forward to with such apprehension, that the patient is eagerly inclined to seek for relief, and is but too often driven from one remedy to another with but trifling advantage.

The time at which the pain comes on varies in different cases. In many the pain precedes the discharge, or else the discharge is exceedingly scanty as long as the pain lasts; but as the quantity increases to a full flow, a subsidence of the suffering takes place; in these cases the pain will last only a few hours. In other instances the discharge is more profuse than natural during the whole continuance of the pain, is apparently expelled in gushes, and is then usually mixed with coagulated blood. In a few more rare cases the pain will only occur in the latter part of the menstrual period, accompanied either with a diminution or an increase of the flow, and ceasing only after every vestige of the discharge has passed off.

All these varieties will be found in practice, though in the histories of this disease some have been often omitted, and most authors have described the pain as occurring only at the onset, and ceasing when the full and free evacuation takes place.

The pain often resembles the grinding pains of the first stage of labour, and is similarly in paroxysms of short duration and frequent recurrence. There is also, in the intervals, a constant aching pain down the legs, with a dragging sensation in the back and loins; there is sometimes, also, a sensation of bearing down in the pelvis, with even an actual lowering of the uterus. All these pains will vary in degree; for in some severe cases the paroxysms have been so violent that the patient has rolled on the bed or the floor with agony, and, in a few instances, the writer of this article has noticed severe convulsions of the character of tetanus, even amounting to regular opisthotonos. The expulsion of a membranous substance has been observed in dysmenorrhæa by Morgagni, (Epist. 48, art. 12,) who described it as generally consisting of a small bag, containing a fluid, on which account it was usually mistaken at that time for a very early abortion. More particular notice was attracted to this peculiarity in modern days by the late Dr. Denman, who satisfactorily established the fact that the membrane was expelled at least as frequently in single as in married women, and that it had the appearance of a triangular cast of the cavity of the uterus, having an exact resemblance to the membrana decidua. It would seem that where a bag containing a fluid was really discovered, it must have been an ovum, at an early period of conception, particularly as such women are very liable to miscarry. Dr. Denman was of opinion that this membrane, although often not noticed, was expelled in every case of dysmenorrhœa. That he was wrong in this conjecture is now well known, as, though occasionally met with, it is by no means common, although there are often substances perceived which at first sight resemble it, but which consist merely of coagula of blood, with the colouring matter separated. From the supposition that the membrane is *always* expelled, and that it consists of coagulable lymph exuded from the lining of the uterus, necessarily resulting from inflammatory action, has arisen a very faulty opinion of the nature of the disease, and a most mistaken and pernicious mode of treatment, when *universally applied.*

Dysmenorrhœa may arise at any period of life at which the menstrual function is performed. It will sometimes exist from the time of puberty and cease upon marriage; in other instances the first attack is immediately after marriage, and lasts till the patient becomes pregnant; in some it does not appear until after child-birth. It has been often stated that no woman can become pregnant whilst this disposition to dysmenorrhœa exists; but this is far from being correct; the error arising from the fact that such patients are particularly liable to abortion at a very early period, which abortions have been supposed to be merely unusually aggravated attacks of the complaint. Nor again, as has been generally considered, is pregnancy a cure for a previously existing dysmenorrhœa, unless by great care and management the first two or three months are safely passed over.

It would appear that the immediate cause of this distressing disease is extreme irritability of the uterus; and as it is well known that great irritation is but a step removed from inflammation, it is very probable that in some cases, where a membrane is expelled, inflammation of a peculiar character may be excited. It does not follow as a certainty that the separation of a cast of fibrine from a mucous surface is the result of decided inflammatory action. Some pathologists have gone so far as to dispute the possibility of pure inflammation arising in a membrane where no blood-vessels are to be found, although they ramify profusely in the sub-mucous tissue. The tubular casts of lymph from the lining of the intestines are often brought on by irritation alone, as by the improper and excessive administration of calomel; and in croup, the fibrinous tube, which is occasionally formed in severe cases, is not found adherent by vascular union to the surface on which it is deposited. Although he does not exactly agree in these views, it certainly appears to the writer that the pain of dysmenorrhœa is no proof of inflammation, any more than the pain of labour; and it may be stated that generally there is no other sign of inflammation present but pain; that the pulse is merely quickened during the immediate paroxysm, at which time alone the skin is hot or the face flushed; frequently indeed the skin is damp and cold, and the face pallid. On two occasions, where blood was drawn from the arm during the painful period, no buffy coat or contracted cupped surface was found to exist. Although the writer does not deny the occasional existence of inflammation, particularly in plethoric and robust constitutions, yet he believes that in by far the majority of cases acute irritation alone exists. The women most liable to this complaint are those possessing great susceptibility of frame, who are subject to hysterical affections, and who have strong passions and ardent temperaments. Dysmenorrhœa will often occur only at those periods of life when there is great constitutional disturbance, or much mental excitement, as at the early years of menstruation, or shortly after marriage.

[It is affirmed by Dr. Ferguson (Tweedie's *Library of Medicine*, Amer. edit. iii. 305) that sexual intercourse, immediately previous to the expected menstrual flux, has excited the severest forms of the disease.]

Treatment.—This has varied according to the view taken of the nature of the disease. Those who consider it to be universally of an inflammatory character, have of course recommended bloodletting, local and general, frequent depleting medicines, and a spare diet. Where the deciduous membrane has been certainly and habitually expelled, it is not improbable but that benefit may be derived by local bloodletting to a moderate extent; but *as a general rule*, such treatment is not required, and in many instances it has done considerable mischief by the extent to which it has been carried. By the character of the constitutions usually affected, by the spasmodic nature of the pain, and by the success of a very opposite class of remedies, it would appear that the disease is rarely inflammatory, perhaps never purely so, but that it arises from a peculiarly irritable condition of the uterine organs. On this principle the treatment is twofold: 1. to relieve the immediate pain during the menstrual period; 2. to regulate the general health in the intervals. For the first purpose opium is the best remedy, where it can be borne, and particularly when combined with ipecacuanha, and with camphor in doses of four to ten grains. Immediately before the expected attack, the bowels should be opened by a mild purgative or a warm-water injection; the patient might also put the feet in warm water, or sit in a warm hip-bath. At this time should the pulse be full and frequent, the countenance flushed, and general plethora prevail, the local abstraction of blood by cupping on the loins, or by leeches to the pudenda or groins, might be advisable.* At the onset of the pain, opium (or any of the other narcotics, if more suitable,) may be given in full doses, combined as before mentioned, and repeated every hour or two according to the effect. Belladonna plasters may be applied to the sacrum; injections of warm mucilage, containing belladonna or opium, may be frequently thrown into the vagina; and, in addition, we may direct suppositories of clysters, containing from one to two grains of opium. Hot fomentations to the pubes, loins, and perineum are also frequently of great service. Ether, assafœtida, and ammonia may be taken at intervals. Hot gin-and-water is a very popular remedy, and will often subdue the pain. These medicines, however, should be cautiously administered, should there be much heat of skin and feverish excitement.

In the intervals of the periods the general health is to be regulated, and the constitution to be strengthened so as to be rendered less irritable. It would be advisable, should the patient be married, that intercourse should be avoided for about a week before the expected attack. In the majority of cases the preparations of iron are the best remedies which can be given, combined so as not to produce too great excitement of the circulation. Equal parts of vinum ferri and the compound spirit of sulphuric ether (ʒss to ʒi) may be given two or three times a day, or the mistura or pilula ferri composita of the London Pharmacopœia may also be tried. A useful combination is the sulphate of iron, the compound extract of colocynth, and the soap and opium pill, two grains of each. The natural chalybeate waters seem on the whole to be more serviceable than any artificial preparations. Where iron disagrees, some of the other metallic tonics may be of advantage, particularly the zinc. The vegetable tonics do not appear to be of much use; we must except, however, the senega, which Dr. Chapman, of Philadelphia, has confidently recommended, especially in those cases where a membrane has been habitually expelled. He was induced to try this medicine from a supposed analogy between this form of the disease and croup, as regards the formation of fibrine from a mucous surface; he advises four ounces of the decoction to be taken daily. [Experience has not, however, confirmed this view in either one disease or the other.] In obstinate cases a course of mercury has been found the means of cure, particularly when combined with sarsaparilla. Repeated blisters or caustic issues to the sacrum have also been tried, and in some instances successfully. The bowels should be kept open, but not too much so, and the purgatives should not possess an irritating character. Moderate exercise is advisable, but all violent exertions are to be avoided. The diet should be nutritious, but not stimulating. Cold hip-bathing will be found of use, and much benefit will arise from the regular employment, night and morning, of cold-water injections into the vagina, especially if combined with the superacetate of lead. In a few cases there has been a remarkable connection between the existence of this disease and rheumatism in the same person, and the medicines, such as guaiacum and colchicum, given to relieve the rheumatic symptoms, have at the same time cured the dysmenorrhœa. This was accidentally noticed in a case, some years ago, by Dr. Gooch, with regard to guaiacum, and he consequently was induced to try that medicine where the painful menstruation existed without the rheumatism, and sometimes with success. Further trials, by the writer of this article, have confirmed this observation in several instances, and it is remarkable (since Dr. Gooch's observations were never published) that the same remedy has been highly spoken of by Dr. Dewees, of America, in a recent publication.

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* In the writer's opinion it is only in such cases that bloodletting is desirable; but it is fair to state that many eminent practitioners lay great stress on free and repeated removal of blood in nearly all cases of dysmenorrhœa, from the belief that the pain necessarily denotes inflammation.

[*Mechanical Dysmenorrhœa* is a variety which has been ascribed to the small size of the os uteri, or to a narrowness or stricture in some part of the canal of the cervix. To remove this condition, it has been proposed to introduce a common metallic bougie, of which there are various sizes, from that of the metallic probe upwards. When Dr. Mackintosh published the 4th edition of his *Principles of Pathology and Practice of Physic,* he had treated twenty cases by dilating the os uteri, and had permanently cured eighteen. After that period he had other successful cases; for Dr. Churchill (*Diseases of Females*, 2d Amer. edit. p. 80: Philad. 1843) states that he had employed dilatation in 27 cases, and cured 24, of whom 11 had since borne children. The operation may be performed—the patient lying on the left side—by introducing the index finger of the left hand until it reaches the os uteri, for the purpose of directing the instrument to the part: it is then to be gently insinuated, by a rotatory motion, until it attains the fundus of the uterus. Much force ought not to be employed—and little or no pain is said to attend the operation. That dysmenorrhœa—as the writer has said elsewhere (*Practice of Medicine*, 2d edit. ii. 395: Philad. 1844)—may be induced by this cause, can scarcely be denied; yet it is, doubtless, rare, inasmuch as such a condition of the organ would prevent the flow of the menses altogether: and yet, in many cases of dysmenorrhœa the discharge is more copious than usual. It has been properly suggested by Dr. Ferguson (*loc. cit.*), that the employment of a bougie may operate beneficially by inducing a new action in the parts with which it came in contact, and that this may be the salutary agency—not the mere mechanical dilatation.]

C. Locock.

DYSPEPSIA. (See Indigestion.)

DYSPHAGIA; derived from δὺς, *difficultly*, and φάγω, *to swallow*. This term is applied to express a difficulty or impossibility of swallowing. When the extent and compound nature of the apparatus for deglutition is considered, it becomes obvious that this is a symptom which may arise from many and essentially different causes. Thus, all affections of the mouth, tongue, and pharynx, all lesions of nutrition, circulation, or innervation of the œsophagus, the pressure of tumours on this tube, &c. will give rise to this distressing and often fatal symptom.

In the common acceptation of the word, however, it is used to express affections of the œsophagus itself, either the result of some morbid condition of the part, or of pressure from neighbouring tumours. To these we shall principally direct our attention in this article; first enumerating the principal causes of dysphagia that have hitherto been described. These are

1. Congenital malformations of the mouth, tongue, soft palate, pharynx, and œsophagus.
2. Disease of the mouth, tongue, and pharynx.
3. Disease of the œsophagus.
4. External and internal tumours pressing on the œsophagus.
5. Disease of the cardiac orifice.
6. Affections of the larynx and epiglottis.

The congenital malformations of the mouth, pharynx, and œsophagus, which would act in producing dysphagia, are principally the extreme smallness of the tongue, the *microglossia* of Andral, a state, according to this author, owing to an arrest of development, and the consequent existence of the *hyoid* portion only of the tongue. Under these circumstances deglutition becomes extremely difficult, and several individuals so affected have been obliged to introduce the fingers in order to assist the process by pushing the food into the pharyx. We are not aware of any case of the opposite state (macroglossia) being known to produce dysphagia.

Adhesions of the tongue, either to the lower lip, or to the inferior part of the mouth, have been sometimes observed; indeed Andral considers that state called tongue-tied, to be merely a lesser degree of this malformation.

The last congenital malformation connected with the mouth is the absence of its anterior orifice; this is also to be looked on as an arrest of development; for it is the normal state of the mouth in the early periods of fœtal life.

The pharynx is occasionally irregularly developed, terminating in a cul-de-sac, and presenting partial dilatations and herniæ of the internal membrane through the muscular fibres. The examples of absence of the part, or its duplication, have only occurred in monsters.

The malformations of the œsophagus are stated to be somewhat more numerous than those of the pharynx. Thus, in some cases, the upper portion terminates by a cul-de-sac, between which and the stomach there is nothing but cellular membrane. In other cases this is reversed, the tube proceeding upwards from the cardiac orifice for a few inches, and there terminating. In a few instances the œsophagus has been found reduced to a mere cord, while in others the obliteration did not take place till within a short distance from the cardiac orifice. (*Andral.*) Other malformations are described, such as its division into two canals; (*Blaes, Obs. Med. rarior; see also Billard and Michel;*) its obliteration above and persistence below forming a communication with the trachea, (*Martin, Observateur des Sciences Médicales,* 1825.)

In cases of congenital obliteration of the œsophagus, the symptoms, as observed in new-born children, are sudden vomiting when any fluid is attempted to be swallowed; this vomiting occurring without effort, and the ingesta being thrown up unaltered. In a case of absence of the œsophagus, (*Journal Comp. Dict. des Sciences Méd.*) the drink was ejected through the nose; and it would appear that in some cases, as in stricture, a tumour may be observed in the neck previous to vomiting. The children of course die of inanition. In the case published by Sir Astley Cooper, the infant lived for eight days; in that recorded by Van

Guych three days; and in the example of obliterature first alluded to, the child lived eight days, during which time the stools and urine continued. It is scarcely necessary to remark, that in these melancholy cases we can do nothing but appease the cravings of hunger by nutritive injections and baths.

This is not the place to describe the various affections of the mouth and pharynx, attended with dysphagia, although they constitute the most common causes of dysphagia. For information on these subjects, the reader is referred to the several articles in which the individual diseases of the MOUTH, PHARYNX, &c. are particularly spoken of.

The sources of dysphagia arising from a morbid condition of the œsophagus are, its *acute or chronic inflammation*, the *growth of fungous or cancerous tumours* from its interior, *spasm*, and *paralysis*.

Acute inflammation of the œsophagus does not seem to be a common disease in the adult, the tube at this period of life being but little excitable; but in the infant, according to Billard, (*Traité des Maladies des Enfans,*) it is more frequently met with, which perhaps is owing to the state of congestion in which the mucous membranes are often found after birth. In fact, œsophagitis may be an intra-uterine disease, as is proved by the occurrence of follicular ulceration in the part, in still-born children. The prominent symptom of this disease in the new-born child is an immediate vomiting when an attempt is made to swallow fluids: this vomiting is constant, often without any apparent effort; the milk is thrown up unchanged, and in several cases the usual symptoms of gastric inflammation have not been observed. A remarkable case of this disease is recorded by Dr. Abercrombie, in his work on the Pathology of the Digestive System. The symptoms were fever and difficulty of swallowing; the attempt to swallow sometimes excited cough, and frequently vomiting, with ejection of a soft membranous substance. This disease we have never seen but in one case, where the patient died of acute phthisis, and where there was difficulty of swallowing and vomiting. Here, however, the pharynx was affected.

Much has been written on stricture of the œsophagus, but the true pathology of the disease has not as yet been sufficiently recognized. There can be little doubt that in the great majority of cases it is the result of a chronic inflammation of the whole or part of the tube, producing an hypertrophy of its different tunics, but principally of the sub-mucous cellular tissue. The most perfect analogy exists between it and the disease called scirrhus of the pylorus and cardia, which is now admitted by the best pathologists to be the result of a chronic inflammatory process. The exciting causes, and the history of the various cases of stricture of the œsophagus, tend strongly to establish this opinion. Admitting this to be the case, we may hope to relieve the disease in its early period, and at all events we have a key to its physiological treatment even in its advanced stages.

The thickening is sometimes general, but more commonly partial, and varies from that which would slightly narrow the tube, to its complete obliteration. It is almost always progressive, but Dr. Good mentions a case where the morbid process appeared to have been arrested, after having produced such a narrowing of the tube, as to prevent voluntary deglutition: this state continued for twenty years, during which the patient was supported by means of food introduced by a silver canula into the stomach. But this is a very rare case; almost every patient afflicted with this disease must die a slow and painful death. In some instances ulcerations have been met with above or below the stricture, (*Baillie;*) and in a few the semi-cartilaginous-cellular tissue has become bony, as we see in other cases of chronic irritation of this structure. A dilatation often occurs immediately above the obstruction, which is sometimes visible when the patient attempts to swallow. (*Odier*, Edin. Med. Comment. iii.)

Vegetations and other morbid growths have been met with in the œsophagus, where they produce a great and commonly fatal obstruction. A remarkable case of this kind is detailed by Dr. Monro, in which, whenever the patient retched, a large fleshy excrescence was thrown up into the mouth, reaching to the teeth. On dissection this was found to be a polypus, extending nearly through the whole course of the œsophagus.

We have before stated that dysphagia arising from a morbid condition of the œsophagus may generally be referred to chronic inflammation, spasm, or paralysis; let us, before speaking of the treatment of stricture, contrast the symptoms of these different affections.

1. **Chronic Inflammation or Organic Stricture.**—Invasion slow, the obstruction at first slight, but gradually increasing. Attempts to swallow often exciting great pain along the course of the tube to the base of the skull. Fluids more easily swallowed than solids in the advanced stages. Salivation, cough, hectic, and ejection of purulent matter—duration of the disease considerable. Exciting causes—irritations of mucous membranes.

2. **Active Neurosis, or Spasmodic Stricture.**—Invasion sudden, accompanied with a sense of constriction in the throat, and pain, even when the patient does not attempt to swallow. Disappearance often sudden—occasional relaxation by the use of the probang; relief from antispasmodic medicines; absence of hectic and signs of ulceration; exciting cause often mental emotion; occurring in nervous, irritable, hysteric, and melancholy persons.

3. **Passive Neurosis, or Paralysis of the Œsophagus,** may arise from disease of the cerebro-spinal axis, or occur independently of it. Sudden loss of the power of swallowing *without the symptoms of spasm.* No obstruction found by the probang. Cure by electricity.

Before speaking of the treatment of these species of dysphagia, we must remark that the spasmodic stricture may, from its violence or frequent occurrence, cause organic disease of the tube, by the injury done to the circulation and innervation of the part. In this way a spasmodic may pass into an organic affection, as ileus may pass into enteritis. This fact must always be borne in mind in the treatment of a case of spasmodic dysphagia.

The treatment of organic stricture has been hitherto nearly empirical. In its early stage, when any chance exists of effecting a cure, time is often lost by the exhibition of useless nostrums; and great injury done by using bougies, when the part is in a state of acute irritation. In such a case, every thing that can irritate or excite the part should be most carefully avoided; the lancet should be used, and leeches boldly and repeatedly applied to the neck. These means should be followed by counter-irritation; and it is possible also that the use of mercury might assist in the removal of the disease. Indeed, we have a decided example of its efficacy in a case related by Dr. Munkley, (*Medical Transactions*, vol. i.) where in a very unpromising case, a perfect cure was effected by the use of this medicine. (See also *Rush*, Inquiries and Observations: *Dobson*, Medical Observations and Inquiries, vol. vi.)

In the advanced cases, advantage has occasionally been obtained from the use of the bougie, and the exhibition of hemlock. In such cases a seton would probably be useful, and the diet of the patient must be spare and unirritating.

The treatment of the second species must be that of spasmodic affections generally. It is often connected with deranged bowels, in which cases the judicious use of purgatives, followed by nervous and tonic remedies, will be advantageous. During the spasm antispasmodics may be given. A patient thus affected should avoid all debilitating causes, the use of very hot or cold drinks, and sudden changes of temperature. Constant exercise in the open air seems to be the best preventive.

It is obvious that the treatment of the passive neurosis, or paralysis of the tube, will depend on the presence or absence of organic disease in the brain or spinal marrow. If such should not be present, the best remedy appears to be electricity, of the good effects of which several examples are recorded in Dr. Monro's learned work. In one case the patient could only swallow when seated on the electric stool. This affection seems generally to be curable.

The pressure of tumours exterior to the œsophagus is not an unfrequent cause of dysphagia. They may be enumerated as follows: 1. Aneurisms of the aorta. 2. Enlargement of the bronchial glands. 3. Encephaloid tumours growing from the posterior mediastinum. 4. Enlargement of the cervical vertebræ. 5. Abscess in the neck. And, 6. Bronchocele. The diagnosis of most of these affections is difficult. In the case of aneurism of the aorta, the disease has more than once been mistaken for stricture of the œsophagus; and in one instance the tumour was ruptured by the incautious use of the probang. (*Abercrombie.*) A very remarkable case of encephaloid tumour, producing dysphagia and symptoms of phthisis, is detailed in the *Dub. Hos. Reports*, vol. v., in the report of the Meath Hospital.

The last cause of dysphagia which we shall notice, is the existence of disease in the larynx and epiglottis. On this subject much useful information may be obtained from the work of Louis, (*Recherches sur la Phthisie.*) It is obvious that any state of the larynx which causes pain or difficulty in its movements during deglutition, must be a cause of dysphagia, and there are cases where this is the prominent symptom. Destruction of the epiglottis, or its tumefaction from œdema, will give rise to the same symptom from different causes. Of the last source of dysphagia, two most interesting examples have occurred lately to ourselves. In both patients there was great œdema of the neck, and in the cellular membrane in the neighbourhood of the parotids, and the epiglottis was so swollen as to form a large tumour preventing deglutition. In such cases the drink is discharged through the nose. Free puncturing with a lancet might prove serviceable in this affection.

William Stokes.

DYSPNŒA. Difficult or disordered breathing. This term, which is generally applied to those derangements of the respiratory function which interfere in a *sensible* manner with its performance, would not be inapplicable to all instances of defect in this important process. Although in many instances only a symptom, dyspnœa is one of such importance, that it often becomes a principal object of treatment, as it constitutes the chief danger of the disease. For this reason it is important to examine more closely into its nature, and to distinguish between its several causes.

The muscular act of inspiration is excited by a sensation arising from the presence of black blood in the lungs. This act, in the natural state of the function, removes the sensation by supplying air, which converts the venous into arterial blood. But a variety of causes, presently to be considered, may impede or interrupt this conversion, and then the sensation becomes more or less perceptible and painful, and excites exertions of the respiratory forces, increased in extent and frequency, to relieve it. These may prove so far effectual as to supply the defect and remove the sensation of oppression; then there is hurried breathing rather than actual dyspnœa; but when, as is frequently the case, these supplementary exertions are insufficient to effect the due arterialization of the blood, it accumulates in the branches of the pulmonary artery and veins, and occasions the most oppressive and distressing sensations. A person suffering from them complains of an oppression on his chest, and cannot bear even the weight of the bed-clothes: he feels the room too small, and begs to have the windows opened; he is restless, and endeavours to find relief by sitting up; however great his courage, he is depressed and becomes alarmed by a feeling of impending suffocation. The semi-erect posture, by permitting a more extensive dilatation of the chest, often gives some relief; and to this degree of dyspnœa, obliging the patient to sit up, the term *orthopnœa* has been applied.

As the elements or principal parts concerned in the function of respiration are three, namely, the blood, the respiratory machine, and the air, the causes of dyspnœa may arise from changes in any of these. As the peculiar condition of the blood which is called venous is the immediate cause of the sensation of dyspnœa, so the blood being (if we may use the expression) *more venous* than usual, may give rise to the feeling of dyspnœa, without any derangement of the respiratory apparatus. Of this nature is the dyspnœa arising from violent exercise, which ceases as soon as the flow of venous blood to the lungs becomes moderated by rest. Whether other processes, such as increased secretions, the digestion of blood, &c. be capable of producing the like effect, that is, of so changing the blood, that although the respiration be healthy, this fluid is not arterialized with sufficient rapidity to prevent the feeling of dyspnœa, is uncertain; but the stethoscope teaches us that the function of respiration is more active in some individuals than in others, and that there is also a difference in the same individual at different times. Laennec ascribed certain cases of habitual dyspnœa, in which the sound of respiration was even more distinct than usual, to an increased necessity of breathing, (*besoin de respirer;*) and although we should scarcely admit his instances (chronic bronchitis) to be cases in point, we think such a cause of dyspnœa to be in accordance with the pathological view which we have given. It seldom happens that persons with lungs in healthy action can exhibit such a state, the relative power of the organs being greater than the supposed increased demand: but those whose lungs are defective in consequence of disease, although not usually suffering from the defect, do certainly experience dyspnœa after taking food, and at other times, in a manner that will well admit of this explanation. It is through the blood, rather than in any other way, that diseases of the heart sometimes give rise to dyspnœa; any impediment to the pulmonary circulation causing an imperfection in the oxygenating process.

The following are the derangements of the respiratory function that may occasion dyspnœa:—1. derangements that interfere with the respiratory movements; 2. derangements that obstruct the passage of air to and from the pulmonary cells; 3. derangements in the pulmonary tissue that obstruct the action of the air on the blood.

1. The first of these, namely, those that interfere with the respiratory movements, are of two kinds; *a.* derangements of the mechanism of respiration, including spasm, paralysis, weakness or pain of the intercostal muscles, diaphragm, and other muscles concerned in respiration; rigidity or ossification of the cartilages or ligaments of the ribs, pain or rigidity of the pleura, and distortions of the spine or ribs: *b.* derangements external to the respiratory machine, but interfering with its movements, as pregnancy, abdominal tumours, and acute pain of the peritoneal coverings. Of these causes, spasm and paralysis of the respiratory muscles are the most important. In tetanus, and in paralysis resulting from severe injuries of the brain and spinal marrow, or from narcotic poisons, the dyspnœa thus produced is generally the immediate cause of death. In typhus fevers and other complaints of the extreme adynamic kind, dyspnœa arises from absolute weakness of the respiratory muscles; and hence the utility of stimulants. In other instances of fever, in which the brain is severely affected, the breathing is often hurried—in such cases the affection of the respiration depends on the condition of the brain and nervous system. Acute pain, whether in the thorax or abdomen, frequently produces an apparent dyspnœa, by rendering the full exercise of the organs of respiration intolerable. This especially occurs in pleurodyne, and in some cases of pleuritis and diaphragmitis. Ossification, rigidity, or distortion of the thoracic parietes, and the pressure of abdominal tumours, do not often occur to a degree sufficient in themselves to produce dyspnœa; but by curtailing the sphere of the function, their presence may convert any trivial attack on it, by bronchitis or other cause, into one of a serious nature.

2. The second division of this class of causes of dyspnœa, those that obstruct the passage of air to and from the pulmonary cells, may properly be divided into, *a.* obstructions of the air-tubes, and, *b.* compression of the lung. Obstructions of the air-tubes may proceed from the state of the lining of the tubes themselves, from matters effused in them, or from tumours pressing upon them. Tumefaction of the mucous membrane of the trachea and bronchi, whether proceeding from inflammation, congestion, or œdema, and spasmodic constriction of the muscular fibres of the glottis and bronchi, are the derangements of the tubes themselves which not unfrequently occasion dyspnœa. Effusions in the air-tubes are the causes of dyspnœa in many diseases; and they may be either a redundancy of the ordinary secretion of mucus, as in slight inflammation, or of a new character, as coagulable lymph in plastic inflammation; pus, serum, and pituita in the various degrees of bronchitis and catarrh; blood in bronchial hemorrhage and pulmonary apoplexy; tubercular and other matters from phthisical excavations, &c. Compression of the lung, by effusion into the sacs of the pleuræ and pericardium, whether of air, as in pneumothorax; or of liquid, as in pleurisy, hydrothorax, and dropsy of the pericardium; and by tumours in the thorax; is the other cause of dyspnœa which operates by obstructing the passage of air to and from the pulmonary cells.

3. The last class of derangements of the respiratory function that become causes of dyspnœa, are diseases in the pulmonary tissue itself, obstructing the due action of the air on the blood. Such are, *a.* the obliteration and filling up of the cells by effusion, of lymph, serum, and pus in peripneumony; of blood in pulmonary apoplexy; of serum in pulmonary œdema; and of tubercular matter in phthisis: *b.* an alteration in the condition of the membranes forming and lining these cells or vesicles; such as, the thickening and increased rigidity of the tunics of enlarged cells in pulmonary emphysema; and we conceive that an altered state of the lining mucus, the natural function of which when healthy is to facilitate the transfer of oxygen to the blood, is another cause which may give rise to dyspnœa. We have before noticed an excessive *quantity* of this mucus as a cause of obstruction to the passage of the air to and fro in the air-tubes, but we here suppose such a change in its *chemical quality* as would deprive the function of its aid. The bronchial secretion has been proved by late experiments to be much under the influence of the nervous system, and those cases of what is called nervous dyspnœa, in which signs of bronchial spasm are absent, and the sound of respiration distinct and even puerile, are probably referable to the last-named cause.

Besides in the blood, and in the organs of respiration, dyspnœa may sometimes have its cause in the third element of the respiratory process, the air. A deficiency of oxygen is, perhaps, the only state of the air that can *directly* occasion the feeling of dyspnœa; for carbonic acid, carburetted hydrogen, and other noxious gases, when in considerable quantity, do so rather by exciting spasm or some other derangement of the respiratory apparatus. The stertorous breathing of those who have been exposed to the fumes of burning charcoal is also an indirect effect, and proceeds from the poisonous agency of the evolved gases on the nervous system. Although a defective proportion of oxygen in the air may contribute to the oppression which some persons of low respiratory powers experience in crowded rooms, other causes, such as heat, noxious animal effluvia, &c., have at least an equal share in exciting it. The dyspnœa felt at great altitudes, where the atmosphere is exceedingly rare, may with more fairness be attributed to the cause in question.

When a case of dyspnœa presents itself, it must be of great importance to discover from which of these several causes it arises; which we can never do with certainty without an examination of the physical signs. These will supply the desired information by positive indications in the case of organic disease within the chest, whether effecting the bronchi or the pulmonary tissue; and in the other cases enumerated, auscultation will give such negative signs, as will in the greater number of instances, in conjunction with the general symptoms, lead to an estimation of the true nature of the cause. For the characteristic signs of the diseases mentioned as causes of dyspnœa, we refer to their several articles respectively.

We have cited, however, one instance of the production of dyspnœa, in which, if it be not idiopathic, the symptom is not referable to any distinct disease. We allude to the case of *increased want of breath*,—"besoin de respirer," as Laennec has termed it,—and which we have referred to the venous condition of the blood increased beyond its natural standard. Such a dyspnœa can be detected only by the absence of the signs of every other cause: where, therefore, a dyspnœa occurs, whilst pure air is found to penetrate freely into every part of the lungs, and the diseases which modify the state of the bronchial membrane and its secretion have not existed, the disorder must be necessarily referred to an unusually venous or *carbonized* state of the blood. If we attempt to rise one link higher in the chain of causes, we shall find that physiology reveals to us only one probable mode in which this state is itself produced; and that is, by an excessive formation of those secretions which are, in relation to the blood, defective in carbon. Such is urea, a predominant principle in the urine. From its formation, principally, the carbonic acid exhaled from the lungs is supplied, and if we assume the possibility of deviation from the healthy proportion of this supply, we enter on ground less sanctioned by experience than by analogy. We conclude this subject with the remark, that the medicines which Laennec commended as capable of diminishing the "besoin de respirer," (belladonna, stramonium, conium, &c.,) if they act as narcotics, deadening the *sensation* of dyspnœa, would not be eligible; but if they act, as is not improbable, by diminishing the secretions which render the blood venous, then they really would relieve the function, and not merely stifle the symptom.

C. J. B. Williams.

DYSURIA (from δὺς, *ægre*, and οὖρον, *urina*.) Dysuria, or difficulty in voiding the urine, is a symptom of many different diseases, and arises under a variety of circumstance. Although only a symptom, it well merits careful consideration, from the suffering which it occasions, and the serious consequences to which it often speedily leads.

Dysuria exists in every degree, from the slightest to the most intense, when the difficulty terminates in a total inability to expel the urine. The consideration of the subject in this extended sense will lead us to treat of retention of urine, which, though peculiarly the province of the surgeon, is an object of deep interest to the practical physician.

Dysury is often attended with smarting pain; sometimes the pain is lancinating or shooting, at other times it is accompanied by the most distressing efforts to expel the contents of the bladder, such as have been described in the article Calculus. Pain, however, is not a necessary accompaniment of dysury; thus, the imperfection with which men advancing in life discharge the last drops of urine, although wholly unattended with pain, is a true dysury, though in almost all those cases where the expulsion of the urine is prevented by a deficient power in the muscular coat of the bladder, there is no pain. In such instances, as the difficulty of discharging the contents of that organ increases, no urine escaping, or only a small quantity constantly dribbling away, the urine gradually accumulates and produces distension of the bladder. If the progress of the disease has been slow, and the patient is not of an inflammatory habit, the bladder sometimes acquires a size almost incredible. It expands in all directions, pressing downwards, backwards, and laterally, filling all the pelvis not occupied by fixed viscera, and forcing behind and above it those that are moveable. Under such circumstances the bladder has risen to the umbilicus, or even higher, pushing up the adjacent organs upon the diaphragm, and thus impeding respiration. Such enormous distension has occurred chiefly in females, in whom the bladder is much less irritable than in men; and the quantity of urine evacuated by the catheter in these cases has sometimes amounted to twelve quarts. Instances, indeed, are recorded where it is said to have been more than five times as great; but in all probability many of these extraordinary histories have originated in mistake or exaggeration. Frank relates a case in which forty quarts of urine were found in the bladder after death. (J. P. Frank, De curand. hom. morb. Retentio urinæ.) To allow of such expansion of the bladder, its coats must be healthy and pliant, which in many instances of urinary disease is far from being the case. When this organ is indurated and contracted, a comparatively small accumulation of urine may prove fatal.

The fluid descending through the ureters finding a resistance to its entrance into the bladder, fills and dilates those tubes, and at length produces the same effect on the cavities of the kidneys. The pressure thus caused on them diminishes or wholly arrests their secretion, while the absorbent vessels carry a part of the urine into the circulating mass. The perspiration, which now becomes profuse, has a strongly urinous smell, and the taste of urine has even been perceived in the mouth. (Heberden, Comment. de Morbis.) Under such circumstances inflammation of the distended viscera speedily takes place; and if no relief be obtained, the urine escapes by a gangrenous aperture in the bladder or urethra, into the surrounding cellular substance, or into the peritoneal cavity. The extent to which the urine is diffused in the cellular membrane is often extraordinary, sometimes reaching as high as the soft parts covering the chest. When the urethra has given way behind a stricture, the scrotum is usually swollen enormously by the acrid fluid, which strikes with gangrene whatever it touches: at other times, the only *visible* indication of what has happened is a dark sphacelated ring surrounding the orifice of the urethra.

Retention of urine, when accompanied by inflammation, is always productive of great constitutional disturbance: the skin is hot; the pulse rapid; the thirst urgent; the tongue speedily covered by a dark crust, and great anxiety and restlessness prevail. Vomiting, hiccup, and extreme tenderness of the abdomen indicate the communication of disease to the peritoneum; low delirium comes on, and the patient dies comatose or convulsed.

We can in general depend on the report of the patient as to the existence of difficulty in expelling the urine; but it often requires a very careful examination, before we can ascertain the true state of the bladder. The urine may flow with pain, or dribble away insensibly, or the patient may feel not the slightest inclination to discharge it; yet under all these circumstances the bladder may become disturbed to such a degree that the most dangerous consequences result from neglecting to relieve it. Distension of the bladder can seldom be mistaken, if the finger be applied to its lower fundus through the rectum or vagina, while the other hand is laid upon the hypogastrium; in general a distinct undulation of the fluid may be produced by this method. All doubt, however, will be removed by calling in surgical aid, and having the catheter introduced. Some striking instances are recorded, where the bladder in a state of excessive distension has been mistaken for a collection of purulent matter, or for abdominal dropsy, or ovarian tumour; and proposals have been made for the evacuation of the fluid by tapping.

Causes.—The circumstances which interfere with a due performance of the excretion of the urine are very numerous. Dysury may arise from the acrimony of the urine irritating the passages through which it is forced, and increasing their natural sensibility; thus, both alkaline urine and that which contains an excess of acid, have this effect. Difficulty in voiding the urine is also occasioned by an irritated or inflamed condition of the urinary organs, or of the adjacent and associated parts; by which the healthy sympathy between the muscles which retain, and those which expel the urine, is disturbed or destroyed. Thus, dysury exists in gonorrhœa; with inflamed prostate gland; with urinary calculus in any of the tubes or cavities, provided it occasion irritation; it also exists in cystitis; in inflamed ureter; in nephritis; and with inflamed hemorrhoids; inflammation of the rectum, and irritation of it from worms, or from the tenesmus of dysentery. The dysuria which accompanies this last disease is often productive of great distress, and has in our own experience sometimes occasioned retention, requiring the warm bath, and even the catheter. Dysuria also occurs in the painter's colic, from a sympathy between the bladder and the intestines in their state of spasmodic irritation. The irritations and inflamed conditions of the vagina and uterus produce dysuria: thus it is met with in the newly-married; in cases of gonorrhœa in females; in the early period of pregnancy, and as a warning symptom in approaching abortion. Dysuria is likewise a principal symptom of the warty excrescence which occasionally forms at the orifice of the female urethra. (*Clarke*, Diseases of Females.)

A frequent cause of dysury, and of its more aggravated form, *strangury*, is the internal exhibition of cantharides, and their external application in the form of blisters and issues: we have also known vesication from scalding water produce the same symptom; but this sympathetic effect is of rare occurrence. Other substances, of a much milder nature than cantharides, are productive of irritation of the urinary organs when taken in excess: thus Rhenish wine and new beer have been known to occasion dysuria; and the latter is considered by continental writers as no unfrequent cause of puriform discharge from the urethra. Increased secretion of urine, as in diabetes, and from the operation of diuretics, is often attended with pain and difficulty in voiding it. In some individuals asparagus is productive of much urinary irritation; but we have never observed this effect from gooseberries, which are more powerfully diuretic than many drugs referred to this class in the Materia Medica.

Dysuria sometimes exists, as a mere nervous affection, in connection with hysteria; and sometimes it arises from neuralgia of the bladder. The influence of dentition, which is so often manifested in disorder of the digestive organs, is occasionally extended to the urinary apparatus. This affection is also produced by everything which mechanically obstructs the discharge of urine: thus, strictures of the urethra or prepuce; enlargement of the prostate gland; varicose veins at the neck of the bladder; polypous or fungous growths of its internal lining; introsusception of the bladder, (*Aubin*, Pathologia Externa, t. ii.) the intestines falling into the cavity so produced; projecting folds of the mucous membrane — are all occasional causes of dysury. It may also originate from calculi in any of the urinary passages, from the kidney downwards; from hydatids; coagula of blood; inspissated mucus; false membranes or laminæ of coagulated albumen plugging the ureter or urethra. Morgagni (De Sedibus, &c. Epist. 41, sect. 13.) and others have given accounts of such membranes, found in the bladder or urethra, or expelled with the urine; but cases are also recorded which serve to support the idea that part of the internal surface of the bladder is sometimes thrown off and discharged by the urethra.*

Through the kindness of Dr. Weir, a remarkable case of this nature fell under our observation some years ago. A female, who was delivered by the forceps, after the head of the child had been arrested for twelve hours, had, two days afterwards, an inflammatory attack with pain in the hypogastrium. Incontinence of urine followed; several small sloughs came away, and one was extracted from the meatus. About three weeks from delivery, retention of urine took place, and, after many hours, a large slough was forced off suddenly with a gush of urine, which continued to flow to the extent of two quarts. On carefully examining the slough, it was found to consist of a thin membrane without any perforation, six inches in length by four in breadth. One of its surfaces was granulated, rough with earthy particles, and stained with blood of a brown colour; the other presented the appearance of cellular membrane, with small flattened masses of what looked like adipose tissue. It was very extensible, and on minute inspection an appearance of muscular fibres could be traced within its substance. That the bladder had in this case suffered a very severe injury was obvious: for the urine, for some time before and for a considerable time after the discharge of the slough, was mixed with blood, and deposited much purulent mucus: there was also at one period a phosphatic deposit from the urine, and two minute spongy calculi were voided. No opening could be detected between the vagina and bladder; and after the slough had been discharged, six or seven ounces of urine were from time to time voided in a stream.

The obstruction producing dysuria is sometimes dependent on a change in the position of the bladder, as in hernia of that organ, and in prolapsus of the rectum or uterus.

Ruysch gives a very curious case of complete prolapsus of the uterus, accompanied by the most excruciating urinary sufferings, in which he cut into the front of the prolapsed tumour, and extracted several calculi with a successful result. (Obserb. Anat. Chirurg. Ob. 1.)

On other occasions the cause of obstruction to the flow of the urine lies exterior to the bladder and urethra; as when it arises from ligatures round the penis, swelling of the prepuce, aneurism of the corpora cavernosa, abscesses in the vicinity, carcinomatous indurations, tumours within the pelvis, the gravid uterus, retroverted uterus, the menstrual fluid collected behind an imperforate hymen, fæces or other hard substances lodged in the rectum.

Inability to void the urine sometimes arises from rupture of the bladder, which may either be complete, or involve only the mucous and muscular tunics. The sudden occurrence of pain in the region of the bladder, and incapacity to expel the urine after the reception of an injury, the absence of tumour of the bladder when examined through the rectum or vagina, and the scanty discharge of jets of bloody urine by the catheter, will in general point out the real nature of the accident. It is to be observed in relation to the diagnosis, that although the bladder have been ruptured, there is often circumscribed tumour in the hypogastric region. In an instance of ruptured bladder which occurred in our practice some years ago, a urinary abscess which pointed in the hypogastrium was punctured on the twelfth day after the accident, and the patient survived till the twentieth. On inspection, the small intestines were found glued together, and to the abdominal peritoneum, by an albumineus exudation; and thus a partition was formed between the upper and lower portions of the abdominal cavity, which stretched across in an arched form a little below the navel. The lower cavity, which was of great extent, and communicated under the left Poupart's ligament with a sinus passing for several inches down the thigh, was more than half filled with putrid urine, pus, flakes of albumen, and liquid fæces; for the intestines had given way in several places. The bladder was seen lying collapsed in its natural situation, and presented posteriorly, on the left side of its upper fundus, a rounded opening about two inches in diameter. The peritoneal coat was extensively separated at this point, and its edges hung loose in flocculent shreds. It is probable that in this case only the mucous and muscular tunics were at first ruptured, and its long duration afforded some slender hope of a favourable termination: the only chance of success was from an early puncture of the hypogastric tumour, which we proposed in the second day after the accident, but it was overruled in consultation.

Dysury often originates in a want of power in the muscles which expel the urine. The muscular fibres of the bladder, if long kept on the stretch, gradually lose more and more of their contractile force, and at length become wholly paralysed. Instances of this description are of daily occurrence, when individuals have been prevented from emptying the bladder by delicacy, or by the absorbing engagements of business or pleasure. The pressure of the child's head in the latter stages of parturition often keeps the urine pent up, and thus induces inability to expel it after the obstacle is removed. The same loss of power in the fibres of the bladder, though in a much more dangerous form, arises from affections of the brain and spinal cord, and from pressure and disorganization of the nerves which supply the bladder: in this way difficulty of voiding the urine occurs in fevers, in extravasations and effusions within the cranium, in pressure from fractures of the bones, and in injuries and chronic diseases of the spinal cord.

Among the causes of dysuria, there is none more familiar to common observation than the exposure of the body to cold. It acts by producing a contraction of the urethra, more especially in men, disturbs and destroys the natural consent of parts, and in the end induces a torpor of the bladder. Wherever a predisposition to dysury exists from mechanical obstruction or otherwise, the action of cold becomes an immediate exciting cause.

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* *Rohaut*, Mémoires Acad. Roy. des Sciences, 1714. (The membrane had distinct blood-vessels — a male.) *Koch*, Haller Disputat. Medic. t. iv. (A female after abortion.) *Ruysch*, Adversar. Anat. Dec. ii. n. 9. (A female after parturition.) *Willis*, De Urinis, cap. v. (A female suffering under calculus.) *Fahner*, Beyträge zur practischen und gerichtlichen arzney kunde, b. i. u. v. *Guisard*, Pratique de Chirurgie.

Treatment.—In attempting the treatment of cases of difficulty or inability of voiding the urine, our first object ought to be to ascertain the cause from which it proceeds, and, if possible, to remove that which has occasioned the symptom: if we succeed in accomplishing this, the dysury in a great majority of cases will cease. In every instance of this affection it is of especial importance to discover how far it is connected with an inflammatory or plethoric condition of the body, or of the urinary organs in particular; and should it be so, to have speedy recourse to bloodletting and leeches. When dysury occurs during pregnancy, or is symptomatic of approaching abortion, the adoption of this practice will generally be required.

When the affection is of a spasmodic character, or accompanied by pain or irritation, the warm-bath, warm applications of various kinds, and opiates by the mouth, friction, or enema, will be found of the greatest utility. The last of these remedies is particularly serviceable in that form of dysury which is caused by the application of cantharides. In many cases of dysury, even where it depends on a certain degree of mechanical obstruction, the operation of a smart purgative has produced immediate relief; and in every instance it is a safe rule to unload the bowels as speedily as possible, for by this means we relieve the neck of the bladder from pressure, and promote the healthy sympathy of the parts. In dysury and retention of urine of a spasmodic character, the tincture of the muriate of iron, in small repeated doses, has proved a valuable remedy in the hands of the late Mr. Cline and many others. The sudden effusion of cold water on the genitals and neighbouring parts has sometimes procured a flow of urine when all other methods have failed, partly, perhaps, by causing a relaxation of spasm, but chiefly by rousing the contractile powers of the bladder. But when the vigour of this organ is actually impaired, we must have recourse to stimuli of far more effective and permanent operation. Blisters to the loins and sacrum, the formation of eschars by moxa or potassa, and the cautious exhibition of cantharides, are the remedies which will be found of most avail.

When dysuria appears to be connected with the scanty secretion or acrimonious quality of the urine, diluents are to be given freely, along with such mild diuretics as the spiritus ætheris nitrici, spirit of juniper, decoction of the fibrous roots of the leek, liquor potassæ with hyoscyamus, bicarbonate of soda, or Seltzer water. Stronger diuretics are in severe cases given with advantage, such as the parsley breakstone (alchemilla *arvensis*), seeds of the wild carrot (daucus *sylvestris*), and the oil of turpentine. Dysury from alkaline urine must be treated on the plan already laid down in the article Calculus.

Should inability to void the urine have arisen from long voluntary retention of it, the patient ought to immerse his feet in warm water, and, placing the penis in a basin of the same, make gentle pressure on the hypogastrium, and endeavour to evacuate the bladder, when he will often succeed without any farther assistance. The immersion of the penis in warm water rarely fails to give great relief in the painful micturition which attends gonorrhœa. When difficulty of voiding the urine occurs, as it very often does, after parturition, the simple expedient of making pressure on the hypogastrium with a warm sponge will not unfrequently save the patient from the necessity of having the urine drawn off by the catheter. But to this instrument we must have recourse in very many cases of retention of urine; and it is fortunate that the surgeon possesses in it the means of removing a symptom which is at once most distressing and dangerous. The catheter, however, is not always successfully employed, even by surgeons of acknowledged eminence and dexterity; and it then becomes a question how the danger can best be averted. If the symptoms are not urgent, a little delay may still be allowed, to give a farther trial to the most important of the remedies already enumerated, and to the well-directed employment of sounds and catgut bougies; but we must on no account wait so long as to incur the slightest risk of gangrene or rupture of the bladder. The only means now remaining by which the life of the patient can be saved, is, to puncture the bladder, or open the urethra behind the obstruction, should such be the nature of the case. This, however, is in the province of the surgeon, and therefore foreign to the nature of our work.

W. Cumin.

[EAR, DISEASES OF THE. (See Otalgia and Otitis.)]

ECTHYMA, (from ἐκ, *ex*, and θύειν. *fervere*,) a disease of the skin, characterised by an eruption of phlyzacious pustules, neither contagious nor infectious.

Synonymes.—Τέρμινθος vel θέρμινθος,* et ἐπινυκτίς,† (*Græcorum;*) therebinthus, (*Latinorum;*) albotin vel albotes,‡ schera et botsor,§ (*Araborum;*) terminthus, (*Wiseman*, *Turner*, *Lorry*, *Plenck;*) epincytis, (*Sauvages;*) psoride crustacée, (*Alibert;*) Erbsenblattern, (*Teutonicè sec. Plenck;*) eiternde Flechte, (*sec. Sprengel;*) *pupulous scall; ulcerated tetter.*

By the term with which Willan chose to desig nate this disease he lost hold of the thread which led us to the knowledge which the ancients had concerning it. In the synonymy we have endeavoured to recover it, thus to connect ancient experience with modern observation, the only substantial use of learning.

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* "Some will have the denomination from the likeness of the pustule to the fruit of the *terebinthus*. Others, with more reason, read it ἐρέβινθος, *cicer*, which it somewhat resembles." Turner. Vide Hipp. Epidem. lib. ii. sect. 11; De Humor, xi. 1; Galen. in Exeg. dict. Hipp. item Comment. 3, De Humor. et Comment. 4. in lib. vi. Epidem.; Ægin. l. iv. c. 4; Ætii. lib. ii. tætrab. iv. c. 63; Fœs. Œc. p. 615, 616; M. Aurel. Sev. l. de Epinyctid. part. ii. contr. 3; Dioscorides Alexand. vide Gorræi defin. Med.; Oribas. lib. vii. Syncop. cxxxvi.

† From ἐπι and νὺξ. so called, according to some, because the eruption first appeared, or only appeared, by night, and, according to others, because it was most troublesome at night. But whatever be the reason of the etymology, it is plain, from the description of this eruption left us by the best authorities, that it consisted of phlyzacious pustules. Vide Hipp. Prorrhet 2, De Intern. Affect.; Celsus, lib. v. c. 28, sect. 15; Paul. Ægin. lib. iv. cap. 9; Oribas. Synops. lib. vii. c. 37. The Arabians translated the term by *sera* or *schera*, and sometimes *botsor*, (Avicenn. lib. iv. fen. vii. tom. iii. c. 1.) which last being of the same etymology, restored it to its natural connection with *terminthus*. Actuarius, as it appears to us with little show of reason, insists on a distinction between *epinyctis* and *terminthus*, (Meth. Med. lib ii. c. 11, 12.) Some authors, bearing entirely upon the derivation of epinyctis, have been led into the mistake of considering it the same as the urticaria *tuberosa*—an error which Sennertus very properly corrects.

‡ Fallop. l. de Morb. Gall. c. 5, tom. i. p. 686.

§ Avicenn. lib. iv. fen. 3. t. i. and f. 7, t. iii. c. 1; Hensler de Herpete, p. 30; Roussel de Herpete, § 99.

The eruption in this disease consists of large round pustules generally distinct and sparingly scattered, each having a hard, red, elevated base, terminating in a thick, hard, greenish or dark-coloured scab, which, falling off, leaves generally a livid red spot of longer or shorter duration, sometimes a superficial cicatrix, more rarely an ulcer, seldom a tubercle.

This eruption is frequently confined to the extremities, appearing most commonly on the legs, on the outer side of the thighs, arms, and forearm, frequently on the abdomen, nates, lumbar region, neck, and front part of the chest, rarely on the face or scalp, and very seldom occupies the whole body.

The pustules sometimes break out together in successive crops; but generally they appear, go through their progress, and terminate, independently of each other, some being on the decline whilst others are appearing.

This eruption is sometimes, but not generally, accompanied with fever; it is more frequently attended with restlessness, a state of general irritation or erethism, and sleepless nights. Morbid phenomena produced by gastric and intestinal irritation, as anorexia, &c., almost always appear during the course of the eruption. Sometimes fever, anxiety, great general distress, and pains of the limbs precede the eruption, which subside on its appearance. If the pustules be abundant, thickly set, violently inflamed, and acquire a great size, considerable symptomatic febrile action may be present; and if they ulcerate, are slow in their progress, and of long continuance, emaciation, debility, and regular paroxysms of hectic fever supervene.

Each pustule generally commences in a circumscribed red inflamed point, which becomes gradually raised, and in the course of a few days acquires a size varying from that of a lentil to that of a sixpence; their apex is soon observed to point with pus, whilst the base continues hard, circumscribed, and of a bright red colour; at the end of three or four days the pus dries, and scabs, more or less thick, are formed, which, when they fall, leave spots of a dark red colour. The pustules vary in size, from that of a small pea to that of a sixpence or larger. They are generally distinct, but sometimes they form irregular clusters. Their development is frequently accompanied with very acute stinging pains, similar to what precedes *erysipelas*, or the *herpes zoster*.

From this their usual course considerable deviation is sometimes observed. Their progress is sometimes tediously slow and imperfect. Suppuration in some cases is established rapidly, and in others it is only effectual after many days; sometimes the pus is in very small quantity, occupying only the apex of the pustule, the base remaining broad, hard, and inflamed; sometimes, more especially on the hands and feet, the pus raises the cuticle over all the extent of the pustule, giving it the appearance of a bleb or *bulla*. Some of the pustules are occasionally resolved, thin, white scabs forming successively over their surface; sometimes ulcerations, more or less deep, succeed the pustules, especially those seated on the lower extremities, or such as follow scarlatina or small-pox, and sometimes slight indurations succeed to the scabs. The pustules are not always distinct, but sometimes as it were confluent, and though generally accompanied with a burning, itching or stinging pain, they are also sometimes entirely free from any painful sensation.

It has been doubted whether the term pustule was properly applied to the eruption of ecthyma, which supposes an active inflammation and suppurative action to constitute the essence of the disease,—a supposition inconsistent with the state of system existing in all cases as the predisponent cause of this disease; and it has been asserted that a minute examination does actually disclose a state of vessels differing materially from such an action; that, instead, a lesion of some minute vessel takes place in each spot of ecthyma, and a kind of petechiæ are thus produced. But from some cause, depending either on a minor degree of debility of the system to that in which the petechiæ remain quiescent, or on a greater degree of irritability of the skin, attempts are made to repair the mischief by the vessels of the part, and inflammatory action takes place. The minute vessel thus ruptured has its extravasated contents mixed with the coagulable lymph poured out by the vessels labouring to repair the mischief, and the mixed fluids, drying on the spot, form the minuter scabs. But the constitution being unequal to carrying through the process in a healthy manner, irregular attempts at suppuration take place, and the bulk of the scab is usually surrounded by and partly mixed with a minute portion of ill-formed pus, which, drying, increases the bulk of the scab. Many of the minute vessels concerned in this process being too relaxed, their secretion is mixed with and deeply coloured by red globules, which escape under the increased action. The scab now becomes a cause of irritation to the surface on which its basis rests; the bloody purulent secretion increases, becomes inspissated, and attached to the mass; ulceration gradually destroys the surrounding cutis, and the margin of sound skin becomes elevated and thickened. The scab, by the continuance of this process, is gradually elevated and rapidly enlarges, a fresher and broader ring of growth being added to its basis every three or four days. (*Plumbe*, on Diseases of the Skin.)

This ingenious account of the process of the eruption of ecthyma is not in strict accordance with the phenomena, but, on the contrary, is in many respects at variance with them: it rests in its chief points upon suppositions purely gratuitous, for it has yet to be ascertained, and we are inclined to deny it, that even petechiæ are nothing more than ruptures of minute vessels; and it is directly contradicted by other observers who have examined attentively the structure of the pustules of ecthyma at the different stages of their progress. According to them, in their *first* state of red elevations, there exists only a vascular injection with a round circumscribed tumefaction of the skin; that, in their *second* state, a certain quantity of purulent serosity is deposited, under the epidermis, at their summit, more rarely over all their surface; that, in their *third* state, a substance of the nature of a false membrane is deposited in the centre of the elevation, which is evidently perforated; that, in the *fourth* state, after this substance has been extracted and the epidermis removed, the pustule appears in the form of a little cup surrounded with a hard broad border; and that, in their last and *fifth* state, the border, during the following days, gradually disappears, whilst a small cicatrix is formed under the scab, the centre of which is sunk into the point where the perforation has been observed.*

The phlyzacious pustules of ecthyma may be developed in the healthiest body by the local application of certain irritating substances. Thus tartar emetic, in powder or in ointment, after the manner of Autenrieth, is capable of giving rise to them; and the same has been observed of certain pulverulent matters, as metallic powders, sugar, and lime, which accounts for its being frequently seen in masons and grocers. But it is more commonly met with as a symptom and effect of a general disordered state of body, or a sympathetic consequence of irritation or inflammation of some internal organ. Hence it has been observed to supervene upon unusual fatigue, long-continued exertion, much night-watching, great mental anxiety, and strong moral affections: and it has been most frequently observed in persons who have injured their constitutions by previous excesses, by the abuse of spirituous liquors; or who have suffered in consequence of deficient nourishment, or unwholesome food, or surfeits; whose health has been impaired by dwelling in dark, damp, cold, and close habitations; or by habits of sloth and uncleanness; or whose constitutions have been debilitated by the effects of malignant fevers, as small-pox, measles, and scarlatina. Hence it is favoured by a moist and cold atmosphere, though it occurs most frequently in spring and summer, and is met with frequently in infants, in the decline of life, and in women, more especially during pregnancy, or whilst suckling, or coexisting with amenorrhoea; and is frequent in large cities, hospitals, prisons, garrisons, work-shops, and manufactories. For the same reason it is so often accompanied with symptoms of gastric and intestinal disorders, with loss of appetite, pain in the epigastrium, irregularity of the bowels, lassitude, headach, &c.; and has been observed frequently coexisting with chronic inflammation of the mucous membrane of the stomach and intestines, with such concomitant symptoms as inflammation of the conjunctiva, and of the mucous membrane of the pharynx; and has sometimes been observed to be critical in acute *gastro-enteritis*. In predisposed habits, trifling local irritation will produce it, as leech-bites, and even the friction of the clothes; so that some authors have remarked the pustules to be frequently seated under the wristbands and collar of the shirt, the waistband of the breeches, and at the gartering place above the knee.

Though the eruption of ecthyma preserves its character with comparative constancy, and is one of those cutaneous affections the least convertible and disposed to pass into others, it sometimes developes itself in the exacerbations of other inflammations of the skin, as in *lichen*, *prurigo*, *scabies*, and *variola*, but shows, in general, a closer connection with *furunculi*.

Though such is the general appearance, course, and causes of this disease, they admit, as we have noticed, of considerable diversity, sufficient, in a practical point of view, to justify a division of the genus into several species; and though we prefer the specification of Willan and Bateman to that of Alibert, (*psoris crustacea acuta* and *psoris crustacea chronica*,) as being more true, precise, and practical, we shall venture upon a slight alteration of the name of one species, so as to make them all more distinct and consistent; and shall add to the genus the syphilitic form of the disease. The following will therefore be our arrangement.

1. Ecthyma *vulgare*.
2. Ecthyma *infantile*.
3. Ecthyma *luridum*.
4. Ecthyma *febrile*.
5. Ecthyma *syphiliticum*.

1. Ecthyma vulgare.—*Syn.* Epinyctis vulgaris (*Sauvages*); Psoris crustacea acuta (*Alibert*); Ecthyma aigu (*Rayer*); die gewöhnliche eiternde flechte (*Teutonicè*).

In this species of ecthyma, generally after some days of languor and general oppression, of loss of strength and appetite, of derangement of the digestive functions, of headach, of pains in the bowels or of the limbs, and after less refreshing nights, with, more rarely, redness and inflammation of the conjunctiva, and sore throat from erysipelatous inflammation of the pharynx, an eruption, accompanied with sharp stinging pains, appears on some part of the extremities, or on the neck, shoulders, or breast. This eruption, which is usually completed in three or four days, consists of small red circumscribed elevations of the skin, not yielding or disappearing on pressure; for three or four days they continue to enlarge, becoming surrounded with an inflamed areola, which is hard and circular, and in young subjects of a bright red colour; having suppurated at their apex, which is distinguished by a small dark point, after a day or two they break, discharging first pus and afterwards a thinner fluid, which quickly concretes into dark-brown or greenish scabs. The constitutional derangement which preceded the eruption is now abated; the inflamed areola extends itself, becoming gradually paler as it enlarges; in about a week, all the pain, soreness, and inflammation subside, and the scabs soon after fall off, leaving no mark behind. If they continue adherent to the skin for a longer time, which sometimes happens, they leave, when detached, a dark red spot, or, more seldom, a suficial cicatrix, in size resembling those of small-pox, but less deep. If the pustules be situated in the neighbourhood of lymphatic glands, these latter become sometimes swollen and inflamed.

The whole process of this eruption, in general, occupies from seven to fourteen days, and one eruption frequently completes the disease.

This species is most commonly met with in spring and summer; it affects principally young people and adults, and is occasionally observed in women during gestation. It frequently follows excessive fatigue, severe or prolonged exertion, night-watching, nurse-tending, anxiety, vexation, and other emotions of mind, errors of diet, and indulgence at table. It appears to be very much connected with the state of the digestive organs, but seems to depend upon something more than their mere derangement. It has been well expressed by Bateman, by a state of distress of the constitution. It is also sometimes observed as critical of acute gastro-enteritis.

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* *Ecthyma*, Dictionnaire de Médecine et Chirurgie Pratique.—*Ch. Ed. Asselin* Essai sur l'Ecthyma, Paris, 1827.

In general, this species does not stand much in need of the interference of art. Gentle, cooling, and saline purgatives, as senna, manna, and tartarised soda or potass; acidulous diluent drinks, as whey; and light, cooling diet, afford ample means of cure. In robust, sanguine, or plethoric subjects, a small bloodletting accelerates the progress of the eruption, and renders these means more efficacious. If much irritation and restlessness be present, and much local uneasiness, the tepid bath is the surest means of affording relief. If the alvine evacuations are unhealthy, five grains of the pulv. hydrargyr. cumcretâ may be taken at bed-time, with a few grains of Dover's powder, but even this is seldom necessary. The diluted sulphuric acid, simple or aromatic, is a good tonic as the disease declines. If the local affection demands any treatment, an emollient poultice is the best.

2. **Ecthyma Infantile.**—*Syn.* Terminthi neonatorum—Schälblasen, *Teutonicè* (*Plenck.*)

In infants of a constitution naturally weak, or disordered by bad or insufficient suckling, or by being brought up by hand upon food not suited to the powers of their digestion, an eruption of phlyzacious pustules is a common occurrence.

In this species, as the former, the eruption is partial, chiefly affecting one particular part of the body, and, as in the former also, several pustules may appear together; but more commonly the disease consists of a successive eruption of individual pustules, by which its duration is sometimes extended to several months. The pustules are first observed near the groins, on the abdomen near the umbilicus, near the axillæ, and on the thighs or nates; sometimes they are not confined to the trunk and extremities, but also occupy the face and scalp. The course and progress of each individual pustule is the same as that of the ecthyma *vulgare*, but they are in general more irregular in their size, a large being frequently observed by the side of a very small one; their form is circular, but they vary more in colour, being sometimes of a bright red, sometimes of an amaranthine, and sometimes of a livid colour, according to the strength or weakness of the infant. The pustules of this species are more disposed to suppurate extensively, and more apt to terminate in ulcerations, which in weakly infants heal imperfectly, being covered by a thin, filmy cicatrix, easily re-opening or abraded, marked by a peculiar puckering of the surrounding skin. In some severe cases, generally only to be found amongst the most indigent, gangrenous eschars and deep sloughing ulcers, similar to those of *erysipelas infantile*, are not uncommon terminations of the pustules of this species. Occasionally, also, after threatening suppuration, the pustules gradually diminish and terminate by a succession of desquamations.

The process by which an improper nourishment developes this disease appears to consist not only in a deranged state of digestion and assimilation, but also in the production of inflammatory affections of the alimentary canal; for chronic inflammations of the digestive organs are frequently observed in connection with this eruption. But all the chronic derangements of the abdominal organs of infants are capable of inducing this eruption, and hence phlyzacious pustules are common symptoms of the marasmus which depends upon obstruction of the mesenteric glands. Cold and moisture appear frequently to furnish the exciting causes of this eruption. According to Plenck, it has sometimes prevailed epidemically.

The treatment of this species consists in changing the nurse or in altering her milk by diet or medicines, or in adapting the diet of the child to the powers of its digestion. For this last purpose, asses' milk, goats' milk, and whey afford very useful resources. The air, exercise, and clothing of the patient also deserve attention. In mild aperients, as castor-oil, manna, and magnesia, with mild mercurial alteratives and soda, and, if there be any feverishness or fretfulness, small doses of nitrate of potass and the tepid bath, the medical treatment consists. As soon as it can be borne, the ferrum tartarizatum, given in small doses, affords a convenient alterative and tonic. The chloruret of potass and the pyroligneous acid, both in small doses, are said to have been found particularly serviceable in this eruption, as, also, the Peruvian balsam and sulphate of quinia. Nor is the local treatment of the pustules, if large, unimportant. If there be much pain or irritation, fomentations of the decoction of poppy-heads frequently afford relief; in superficial ulcers, with profuse acrimonious discharge and itching, weak solutions of chlorine or chlorate of lime are most useful applications.

3. **Ecthyma Luridum.**—*Syn.* Terminthus (*Auctor. Var.*); Psoride crustacée sordide (*Alibert*); ecthyma chronique (*Rayer*).

An eruption of large phlyzacious pustules, sometimes acquiring a very considerable size, having their base hard, elevated, of a dark livid red colour, and continuing highly inflamed, even after scabbing takes place; slow in their progress, extensively distributed over the body, and generally connected with a state of cachexy; these circumstances afford the distinguishing features of this species of ecthyma, which, though in different stages, is accurately represented in Plate XLIII. of Bateman's Delineations, and in Plate LIII. of Alibert.

The pustule of this species is more analogous to an ill-conditioned boil, being more extensive and prominent than is usual in ecthyma. Suppuration is seldom completed in less than eight or ten days, when the pustules break and discharge a curdy, sanious, or bloody fluid, which is soon converted into hard dark scabs, and these are encircled with a hard violet or livid red-coloured areola. The surface covered by the scabs is slow in healing, and the ulceration sometimes extends beyond the limits of the pustule; but the ulcerated cavity is soon filled up with hard dark-coloured scabs, firmly attached, seldom separating for many weeks, sometimes not for months. Though the ulceration extends, it is always surrounded by a deep-seated hardness and by a dark inflamed border, and, when not covered by a scab, which sometimes happens if they have been removed by violence, tedious ulcers, with callous edges, discharging a sanious pus, are often the consequence. When the scabs fall off, dark red-coloured patches, or cicatrices of a violet red colour, remain for a considerable time over the parts which have been occupied by the pustules. Sometimes the pustules are long stationary, and do not proceed to suppuration, but are followed by tubercles of a violet colour; these may, however, ultimately proceed to suppuration and ulceration, and thus leave irregular cicatrices in the skin. In this species the pustules are more entirely independent of each other's progress, and may continue to succeed one another without any order for several months. They are often attended with extreme pain and soreness, generally without fever; but sometimes considerable constitutional irritation is present, and in protracted cases hectic fever: in some cases the respiration is remarkably affected.

Ecthyma luridum is always a symptomatic affection, a consequence of cachectic disorder of the habit. For this reason, it prevails most during the winter season, and is most commonly met with amongst persons advanced in life, or amongst those whose constitutions have been broken down by misfortunes or imprudence. Hence the indigent who inhabit dark, damp, and narrow streets and cellars, whose means and habits seldom allow them the comforts of cleanliness; prisoners confined to dark and dreary dungeons, filthy, squalid, and ill-fed; those who have been exposed to great hardships and hard labour; or those who have been compelled to live upon unwholesome food, particularly such as is hard, dry, smoked, and salted; and such as have abused their health by an irregular life, particularly those addicted to the use of ardent spirits, are most frequently the subjects of this disease. The state of body which prepares for this disease may also be produced by previous diseases, as in febrile affections, when the cure or the crisis has been imperfect; and in this way it occurs very frequently as a sequel of scarlatina, measles, and small-pox.

The essential point in the treatment of the ecthyma luridum consists in correcting the faulty state of habit upon which this disease depends, and this object, the cure of the cachexy, is not to be attained by any one simple method of treatment, but by the combination of several,—neither by depuratives, nor alteratives, nor tonics, but by a happy adaptation and adjustment of them all. The experienced physician knows, that to renew and regenerate the organizing and organizable fluids of the body, before proffering a supply it is necessary to excite a demand, and that to give vigour and activity to the function of nutrition, it is useful to diminish the volume of the nutritive fluid; that, whilst in this way activity is given to the process of nutrition, care should be taken to modify, by the proper use of alteratives, the action of the organs, by whose united functions the nutritive fluid is created; and that these actions may be performed satisfactorily and effectually, it is necessary by stimulants or tonics to support the action of the nervous system, until the new, fresh, and healthy blood is of itself capable of doing so. In these three intentions, the indications of the cure of cachexy consist. Therefore, in the commencement of the disease, mild cooling purgatives, or very small repeated bloodlettings, (from two to four ounces,) and light nutritious diluting drinks, are good preparatory measures; whilst any distressing irritation may be relieved by opiates, the action of any organ which is deficient may be solicited or modified by its appropriate specific stimulus, and the vigour of all may be increased by exalting artificially that of the nervous system. From this view the practitioner will readily understand the application of such remedies as sarsaparilla, guaiacum, and taraxacum; of saline mineral waters; of antimony and mercury, either alone or as they are more conveniently united in Plummer's pill; of vegetable and mineral acids, of decoction of cinchona, of sulphate of quinia, and chalybeates; of the fresh and sea-water tepid bath and cold sea-bathing; of whey, asses' milk, milk diet; of food, light, nutritive, and easy of digestion; of wine in small quantities; of gentle exercise in open dry air; of warm clothing; and, as much as may be possible, of quiet and repose of mind.

The local treatment, when the state of the pustules demands it, consists in emollient applications and softening plasters to favour a benign suppurative process; but when they show any malignant appearance or disposition to gangrene, it is best arrested by nitrate of silver in solution, the butter of antimony, or caustic potash.

4. **Ecthyma Febrile.**—*Syn.* Ecthyma cachecticum (*Bateman*); Psoris crustacea acuta (*Alibert*); Ecthyma aigu (*Rayer*).

After febrile symptoms of two or three days' continuance, accompanied by headach, pains of the limbs, loss of appetite, disordered digestion, irregularity of the bowels, great restlessness, and sometimes delirium, there appears an eruption of numerous and scattered phlyzacious pustules, generally smaller than in the other species. The pustules are commonly first observed upon the extremities, to which, either dispersed or clustered together in irregular patches, they are sometimes confined; but they also frequently appear first upon the breast, in other cases on the forehead; and sometimes extend over the whole trunk, the face, and the scalp. The eruption of the pustules is accompanied with a burning stinging sensation, or with itching or tingling, and a great desire to relieve it by scratching. After the first eruption fresh pustules continue to break out daily, until the skin is thickly studded with them; and as the successive pustules go through their different stages of inflammation, suppuration, and desquamation, at similar periods after they arise, they are necessarily seen under all these conditions at the same time; the rising pustules exhibiting a bright red hue at the base, which changes to a purple or chocolate tinge as the inflammation declines, whilst little laminated scabs are formed upon their tops: when these fall off, a dark stain is left, which remains for some time. The pustules which occupy the breast and abdomen are generally less prominent than those on the face and arms, contain less matter, and terminate rather in scales than scabs. Pustules may continue to succeed each other, in the manner just described, for several weeks, the average duration of the disease being from two to four months. The best representation of this species of ecthyma is that in Bateman's Delineations, Plate XLIV.

On the appearance of the eruption the febrile symptoms are diminished, but not removed, for a state of constitutional irritation, of erethism, or hectic, continues during the progress of the disease, which is invariably accompanied by great languor, and by much depression both of the spirits and muscular strength. The pulse is generally quick and small; the skin hot, dry, and harsh; the tongue dry, red, and glazed; the gums tender, swollen, and bleeding easily, sometimes to a considerable extent; and there is generally an inflammatory state of the fauces and pharynx, in which superficial ulcerations may be observed; this inflammatory state sometimes extends to the Schneiderian membrane and conjunctivæ. The legs and feet are occasionally œdematous.

The ecthyma febrile is always a symptomatic disease depending upon an inflammatory state of the mucous membrane of the stomach, and connected with a digestive state of the abdominal circulation, corresponding to that disorder of body described by writers under the term of scorbutic cachexy. In persons of this state of body this eruption declares itself at the change of season, in spring and autumn, from exposure to inclemencies of weather. It occurs most frequently after the body has arrived at full maturity, particularly in those debilitated by a long series of excesses; and it is occasionally seen in the crude convalescence of gastritis imperfectly cured.

The nature of the ecthyma febrile affords satisfactory indications for its cure. If the eruption be extensive, the local inflammation severe, or if it be attended with much fever, depletion by small venesections, by leeches to the anus, epigastrium, or hypochondriac regions, or by cooling saline purgatives, is a necessary measure; whilst the secretion of the liver is to be solicited by mild mercurial alteratives, taking care to prevent their affecting the constitution,—a circumstance, however, liable to occur in this disease, even from very small doses. The mercurial alterative may be combined with antimonials, as the James's powder, or with Dover's powder. These, with the tepid bath if there be much irritation, diluting acidulous drinks and light diet, constitute the means of cure. In milder cases, cooling saline purgatives and acidulated drinks will, in the commencement, be found sufficient; and when the febrile symptoms have abated, the Plummer's pill combined with a course of taraxacum affords an alterative treatment of great value.

These remedies may be succeeded by the diluted sulphuric acid and preparations of cinchona, as soon as the state of the stomach admits them. The warm alkaline or salt-water baths are very useful subsidiary means, and the diet throughout should be mild, light, easy of digestion and nutritious.

When the pustules are the seat of much pain, of itching, or uneasiness, local applications are of considerable use. Of these a solution of chlorate of soda is one of the best. Dr. A. T. Thomson found great advantage from the following:

℞ Plumbi acetatis, ʒss.
Acid. hydrocyan, f.ʒiii.
Unguenti cetacei, ℥iii.

M. fiat unguentum partibus cutis nudis applicandum.

The ecthyma febrile has only been accurately described by Bateman, Alibert, Hewson (North American Medical and Surgical Journal, January, 1826), and Dr. A. T. Thomson (Bateman's Synopsis, 7th edit. 1829).

5. **Ecthyma Syphiliticum.**—*Syn.* Syphilide pustuleuse phlyzacrée (*Kayer*, *Biett*); Pustular venereal disease (*Carmichael*).

Under the influence of the venereal virus, modified no doubt by some peculiarity of constitution, natural or acquired, an eruption of phlyzacious pustules is frequently observed; and which, in a classification founded entirely on the external characters of disease, we are justified in placing under the genus *ecthyma*.

The pustules of the ecthyma syphiliticum succeed each other, are generally sparingly scattered and distinct, and seldom very numerous, and have been by Lagneau, on account of their large size, compared to those of small-pox; they are most frequently seated upon the limbs, and especially upon the legs; but they have been observed upon every part of the body. They first appear under the form of a livid spot, in breadth somewhat less than that of a shilling, but also sometimes larger; throughout a considerable extent of this spot, the epidermis becomes raised and gradually distended by a greyish sero-purulent fluid, whilst the tumefaction slowly increases, and is surrounded by a broad areola, invariably of a livid copper colour, one of the characteristic distinctions of this species of ecthyma. After a few days the pustule opens and discharges a liquid, which concreting forms a very hard blackish or brownish-black scab; the scab becomes by degrees very thick, furrowed circularly, and is generally of a regular round form. The progress of the pustule most commonly takes place without any symptoms of local inflammation; there is little increase of heat; the surrounding parts are free from pain; a slight smarting is all that the patient feels. The scabs are strongly adherent, and they may remain undetached for an indefinite time; but when they fall off, either spontaneously or by means of emollient applications, they expose round ulcerations, most commonly deep, having their edges abruptly precipitous, formed of a hard violet-coloured tissue, and their bottom of a greyish, pale, unhealthy aspect. These ulcerations seldom extend, but the scab gradually forms again, and is successively detached; until at last, by means of appropriate treatment, the new scabs are formed less thick, the ulcerated surfaces become healthy, and are succeeded by a permanent round cicatrix, of a copper colour. (*Cazenave et Schedel*, Abrégé Pratique, &c. Paris, 1828.)

Infants born infected with the syphilitic virus present most commonly this form of eruption. In this case the pustules are very numerous, broad, flat, superficial, and of an oval form. They become covered with blackish scabs, of no great thickness, which are followed by small ulcerations. A very characteristic general appearance of the countenance, which it would be difficult to describe, attends this complaint. The skin is foul, the features are drawn, and the whole body is emaciated, wan, and, as it were, etiolated; the countenance is wrinkled, giving the appearance of extreme old age, and a peculiarly diseased odour is exhaled. (*Cazenave et Schedel*, Op. cit.)

The pustules of the ecthyma syphiliticum are distinguished from those of the other species by being surrounded by an areola less broad, but of a dark copper or violet colour; by their thicker scabs, furrowed circularly; by being succeeded by ulcers round and deep, with precipitous edges, and being invariably followed by a depressed indelible cicatrix, and by being generally attended by some concomitant constitutional symptoms, such as inflammation and superficial ulcerations of the fauces, pains of the bones, sometimes *iritis*, whilst the history of the case affords the evidence of some primary affection.

Mr. Carmichael, who is peculiar in his opinions in limiting the true syphilitic disease to one form of eruption, does not consider the phlyzacious pustules to be of that nature. He considers them as consecutive of a peculiar primary ulcer, which he describes as characterized by a reddish-brown surface, bordering closely on the phagedenic character, having its edges raised and well defined, not excavated, but either on a level with the surrounding skin or considerably raised above it, appearing at its commencement in the form of a small pustule, attended with itchiness. According to his observation the secondary eruption is preceded by fever. (*Carmichael* on Venereal Diseases, 1825.)

The view which Mr. Carmichael entertains of this eruption leads him to consider mercury as unnecessary for its cure; he therefore depends upon antimonials, sarsaparilla, and guaiacum for the constitutional remedies; zinc lotions and rest in the primary affection; sulphur fumigations, or equal parts of tar and sulphur ointment as the local remedies in the secondary eruption. But as this method of treatment has not met with general sanction, the greatest number of practitioners think it safest to have recourse to the specific cure. This has been already described at length under *Acne Syphiliticum*. (See ACNE.)

[This form of ecthyma, as well as that which attacks chiefly the legs of old and cachectic persons who have lived intemperately, is well treated by the iodides, especially the iodide of iron.]

When an infant at the breast is the subject of this eruption, the remedy should be introduced through the system of the nurse, either by administering to her the liquor oxymuriatis hydrargyr., or by the friction of mercurial ointment; and if the health of the nurse does not allow of this manner of introducing mercury, the same may be effected by giving the infant the milk of a goat which has been submitted to the friction of mercurial ointment. These methods have been used at the Hospital of St. Louis at Paris, and followed with the most complete success. But the mercury, if necessary, may be also directly given to the infant; either small doses of the hydrargyrum cum cretâ, or minute doses of the oxymuriate of mercury in decoction of elm bark or emulsion of bitter almonds, as recommended by Dr. A. T. Thomson. (Bateman's Synopsis, 7th edit.)

T. J. TODD.

ECZEMA, (from ἐκζέω, *efferveseo*,) is a disease of the skin, characterized at its commencement by the existence of minute vesicles, which are usually closely crowded together, and terminate either in the absorption of their contained fluid, or in its effusion and subsequent concretion into thin scales. It is accompanied with a burning heat and tingling of the inflamed portions of the skin. The disease is not contagious, is usually unattended with fever, and may, for the most part, be traced to some irritating cause, either acting directly on the cutaneous surface, or internally through the medium of the constitution.

Willan and Bateman, who have always endeavoured to seize on the earliest appearances presented by cutaneous diseases, as being the most constant and characteristic, have placed eczema in their sixth order, *vesiculæ*; whilst Alibert, whose classification is usually founded on the more obvious, though less distinctive, phenomena occurring in the advanced period of these affections, a period when several species which were originally dissimilar often become confounded in their external features, though still unlike as to their eventual progress, and as to their appropriate modes of cure, has placed it in his order "*dartre squammeuse.*" Thus he has grouped it along with some of the true scaly diseases, and along with some of the papular ones. Struck, however, by the abundant serous secretion by which it is usually moistened, (and which should have led him to a knowledge of its essentially distinct nature, by turning his attention to its primitive vesicular form, the source of this moisture,) he adds the characteristic epithet "*humide.*"

M. Biett, who, to an intimate acquaintance with the labours of his own countrymen in this department of pathology, adds an extensive knowledge of the works which have appeared on the subject in England and Germany, usually manifests a decided preference for the classification and general views of Willan and Bateman. But in respect to eczema, he thinks these authors have too many subdivisions of the disease, and have spoken in too sweeping a manner of the absence of inflammation around the vesicles, and of fever; as the former almost always exists to a certain extent, and if the local affection occupies much space, some fever usually results. The latter fact, however, we think is very plainly hinted at, if not expressly stated, by Bateman himself. If the cutaneous affection be very severe and extensive, we often also find inflammation of the mucous membranes to coexist.

Rayer, a more recent writer, whose views often manifest a somewhat singular coincidence with those which Biett has been in the habit of publicly teaching for many years past, emits the same opinion as to the unnecessary subdivision of this affection in the English classification, and proposes to substitute a two-fold division, viz. into *acute* and *chronic*, as more practical and useful than the triple one into *eczema solare*, *eczema impetiginodes*, and *eczema rubrum*; against which, in addition to the want of uniformity in the grounds on which it is formed, it may be objected that the first and third are really the same disease, differing only in respect to their cause, or the degree of attending inflammation; and against the second, that it is really a complication of two diseases, and not a distinct, well characterized, simple species. Averse, however, to interfere with an arrangement so universally adopted in these countries as that of Willan and Bateman, we shall not here deviate from it, convinced that in pathology as well as in pharmacy, the modern taste for uniformity and simplification of nomenclature, whenever it has deprived us of terms recalling well-marked sensible characters, effects or causes, has tended to do injury to a science so strictly practical as that of medicine. Names that make a strong impression on the memory are here often much more desirable than those whose only merit is their consistency with a purely scientific but unimpressive uniformity.

Eczema most frequently appears simply as a local disease, preferring, unlike the true scaly diseases, those situations where the sebaceous follicles abound, as the ears, axillæ, groins, upper and inner part of the thighs, scrotum, margin of the anus, and in women, moreover, the external parts of generation, the nipples, and adjacent portions of the breast; or it selects those parts which are much exposed to external influences, as the hands, arms, and face. At times, however, it is a much more extensive disease, and occupies successively nearly the whole cutaneous surface; and this is especially the case when it originates in the use of mercury, or in some other cause acting through the medium of the constitution.

1. **Eczema Solare** chiefly occurs in persons of a delicate skin, after long exposure to the rays of a summer sun. Sportsmen, and those who take very long walks in this season, mowers, harvest-labourers, and others whose business exposes them to the above cause, are its most frequent subjects. It is occasionally preceded by a slight feeling of general indisposition; and some degree of tension, together with heat and tingling, is felt in the portion of skin which is to be the seat of the eruption. This is most commonly the backs of the hands and fingers, and the face, neck, and arms, especially in women, or those who happen to have them long uncovered whilst in the sun. The skin is usually pale, and is crowded with thick-set microscopical vesicles, so closely approximated as to leave no interstices of redness. Occasionally, however, there is a slight blush round each vesicle; and this species occurs usually, as Bateman mentions, in the upper part of the arms or on the breast, particularly in females, and is commonly called *heat spots*. In men of a sanguineous temperament who use violent exercise in hot weather, phlyzacious pustules, or painful and slowly suppurating tubercles not unfrequently make their appearance in the midst of the eczematous eruptions.

The vesicles are very small and acuminated, and contain a limpid fluid, which soon becomes milky and is absorbed; or after slightly increasing in size, they burst and effuse their contents, which concrete and form minute brownish yellow scales or scabs, and the whole disease, if not very extensive, finally terminates in desquamation within one or two weeks from its commencement. The larger the surface at first attacked, and the greater the irritation, the more likely is the affection to spread successively to new and extensive portions of the cutaneous superficies. Some precursory indisposition, as we have just stated, may occur, but much more frequently it is absent, the eruption coming out almost immediately after exposure to the sun's rays. It usually begins and terminates in an acute form, but at times it passes almost immediately into a chronic inflammation, with an abundant exudation of a viscid fluid, which rapidly concretes in the form of thin scales, and is attended with tenderness, redness, and excoriation of the affected skin. In these prolonged cases, as Bateman remarks, the effused fluid seems to be of an acrid nature, inducing inflammation, and occasionally superficial ulceration of the parts with which it comes in contact, and the disease assumes somewhat of the form of impetigo. The duration of this affection seems to be little under the influence of medicine, and usually requires little more than the protection of the part from the exciting cause, and the frequent employment of tepid ablutions.

2. **Eczema Impetiginodes** is preceded and accompanied by a painful tension, formication, and pruritus, and is distinguished from the other varieties by the occasional intermixture of pustules, into which its vesicles, which are deeply imbedded in the skin, become themselves not unfrequently converted. All this gives it a considerable resemblance to some of the forms of impetigo, to which it is also allied in the similarity, or rather the identity, of its causes, which for the most part consist in the habitual contact of various irritating matters. Thus the irritation induced by the repeated application of lime, sugar, alkalies, &c., to the hands, gives rise to eruptions, (bricklayer's itch, grocer's itch, &c.,) which are vesicular in some individuals and pustular in others, and are apt to assume a chronic form when the exciting cause long continues to be applied. Thus, also, either a vesicular or a pustular inflammation may be induced by the irritation of sulphur or sulphurated alkalies, used for the cure of common itch, and be mistaken for the continuance of this disorder.

Similar eruptions may be caused by a blister, a mercurial plaster, Indian varnish, valerian root, diachylon, frictions with croton oil, opodeldoc, or ammoniacal liniments, and many other stimulating external applications. Exposure to the heat of a forge or a strong fire has sometimes excited it, as has likewise the internal use of various medicinal substances, as opium, antimony, copaiba, &c. Irregularities in diet and excessive drinking are also reckoned amongst its occasional causes. When the skin is very delicate, this eruption has been known to manifest itself within three or four hours after the application of a Burgundy pitch plaster, and to be productive of much distress. We have known an individual in whom almost every species of plaster, even the mildest and least irritating, has given rise to this affection, and have seen it ensue in another after the employment of the common linseed poultice. The mixed eruption of vesicles, pustules, and boils occasionally induced by a blister or other irritating plaster, often extends to a considerable distance from the centre of irritation, overrunning a considerable portion of the chest, back, abdomen, &c., inducing much pain and feverishness, and persisting occasionally, as Bateman remarks, for a fortnight or upwards, but without any eventual injury.

The eczema impetiginodes, if its extent be not great, may run through its course in from one to three weeks. Occasionally, however, it passes into an obstinate pustular or scaly disease, and this we have seen it do within a fortnight after its commencement. In its ordinary course, the vesicles break and discharge an acrid fluid that irritates the adjacent skin, which becomes inflamed, thickened, fissured, and excoriated in streaks, as if torn by the nails. At this period its resemblance to impetigo is still more striking than at an earlier stage.

In the treatment of this affection, in addition to the removal of the irritating causes, and the use of the antiphlogistic and local soothing measures to be detailed at the end of this article, we must at the same time endeavour to remove that morbid state of the system of which the proneness to these eruptions from slightly irritating causes is an evidence; and it is in this part of the treatment of cutaneous disorders that the French practitioners, who have anticipated and excelled us so much in the employment of the antiphlogistic and soothing measures just alluded to, appear to have fallen short; the proper attention to the regulation of the functions of the digestive organs being too often overlooked by them. The most remarkable instances of this extreme irritability of the skin which we have met with, have been in individuals labouring under dyspeptic symptoms of an old date; but we do not by any means wish to insinuate that this is universally the case. Eczema impetiginodes, as well as impetigo itself, seems to fall under the head of *dartre squammeuse crustacée* in Alibert's arrangement.

3. **Eczema rubrum** is the most severe and most inflammatory variety of this affection, and is, like the others, preceded by a feeling of stiffness, heat, and tingling. It takes its specific name from the diffuse or erythematous redness on which the vesicles make their appearance. At first it has somewhat of the appearance of erysipelas, but may be easily distinguished from it by the roughness which it presents to the touch, and which, on minute examination with a lens in a favourable light, is found to depend on the presence of innumerable small and crowded transparent vesicles. These in two or three days become opalescent, and in size about equal to a pin's head, after which they usually burst and pour forth their contained fluid, which inflames and excoriates the parts with which it comes in contact. The disease successively invades new portions of the skin, and is accompanied as it proceeds with swelling of the true skin and cellular membrane. The discharge from the vesicles is often very abundant, has a peculiarly heavy odour, and concretes rapidly into yellowish incrustations. Hardening on the patient's linen also, it causes much pain, by coming in contact with the excoriated surface, which in some cases is so extensive as to occupy the greater portion of the body. When so widely spread and severe, it causes much suffering, and a certain degree of febrile excitement is necessarily the consequence.

It usually makes its first appearance about the scrotum or inner part of the thighs or groins, but this is not constant. Its duration is indefinite. If limited in extent, it may run through its course within a fortnight; but if it has occupied the greater part of the surface of the body, it may last for a couple of months or even longer, when at length the encrusted secretion drops off. But the morbid cuticle continues to exfoliate for a considerable time after, and this is occasionally attended with the loss of the hair and nails. Of this affection, mercury is one of the most frequent causes. The *mercurial eczema* (sometimes miscalled erythema) seems to have been first clearly noticed by Benjamin Bell, in his treatise on Gonorrhœa and Lues Venerea, and was subsequently more fully investigated by Dr. Moriarty, Dr. Spens, and Dr. M'Mullen, and by Mr. Alley and Mr. Pearson.

Dr. M'Mullin's description of it, in the second volume of the Edinburgh Medical and Surgical Journal, represents it as a much more serious affection than Bateman and most succeeding writers have done. According to Dr. M'Mullen, it is ushered in with a well-marked febrile paroxysm, and is accompanied by dry cough, difficult respiration, and sense of tightness across the præcordia —the skin being remarkably hot and the seat of an itching and prickly sensation. On the first or second day, a diffused redness and numerous crowded papulæ (vesicles) make their appearance, generally on the scrotum, thighs, or forearms first, or on those parts where mercurial frictions have been made. The cuticle soon exfoliates, and the fauces and eyes become somewhat inflamed. The above symptoms, which, according to Dr. M'Mullin, characterize the first stage, last for one or two weeks, and if the disease be in a mild form, recovery may ensue immediately after the desquamation; but if severe, a second and much more serious stage ensues, in which the skin is studded with innumerable vesicles, which soon discharge an irritating fluid of a nauseous odour. This, by concreting into large incrustations of a reddish or dark colour, constitutes the third stage. The inflammation of the fauces, eyes, and eye-lids now becomes exasperated, and the face is deformed by a mask of encrustations fissured in various directions. The affection occupies successively a large surface of the body, which in its excoriated state is the seat of great irritation, and the pain is exasperated by the weight of the body in lying, as well as by the contact of the concreted matter. The latter is liable to crack or be torn across on the slightest change of posture, and thus new raw surfaces are continually becoming exposed. A fever of the typhoid type accompanies these extreme cases; yet, which is singular, the appetite continues unimpaired throughout. The catarrhal symptoms generally undergo an exacerbation towards the conclusion, as is manifested by the increased anxiety and pain in the chest, the cough, and bloody expectoration. The pulse becomes frequent, feeble, and irregular, the tongue black and parched, and diarrhœa, delirium, convulsions, gangrene of the skin, and death close the scene.

In the above description we scarcely recognize the comparatively mild disease described by Bateman, whose account certainly agrees much more closely with the affection usually met with in practice.

In mercurial eczema, in addition to the catarrhal affection of the air-passages, a tendency to inflammation in the mucous membrane of the intestines often coexists, as is manifested by the facility with which diarrhœa is induced. Dysury too is an occasional but much rarer symptom. The catarrhal affection is not mentioned by Bateman; and by some other writers, who speak of it, it is considered to be merely a casual complication. Dr. Gregory thought that both the affection of the skin and that of the mucous membrane were the effect of cold caught whilst under mercurial influence; but Mr. Pearson's experience does not confirm this opinion. Rayer strangely intimates that the occurrence of eczema mercuriale may be obviated by taking the precaution of shaving the part to which mercurial frictions are to be made. When we recollect, however, that it may be induced by almost every form of mercurial medicine, and that too whether internally or externally administered, we cannot place much confidence in this mode of prevention. That inflammation of the skin should result from the internal exhibition of mercury, is in no respect more wonderful than that severe and even fatal enteritis should originate in its external employment, as in the instances recorded by Dr. Crampton.

Those cases of eczema rubrum which originate in the use of mercury, are generally the most extensive. Local examples of it on exposed parts seem to be sometimes induced by the influence of very hot weather, and a succession of red patches generally make their appearance in such a manner as to prolong the disease to several weeks, without, however, any evident derangement of the general health. Amongst its occasional causes have been reckoned, a stimulating diet, the constant use of shell or sea-fish, &c. Some individuals are subject from slight or inappreciable causes to a very frequent recurrence of this affection about the ears, face, and back of the neck, accompanied with swelling and redness of the face, and a considerable puffiness about the eyelids; which obtain for it in popular language, but very improperly, the appellation of erysipelas, from which it differs both in its duration and the degree of danger attending it, as also in the presence of vesicles in place of bullæ. Occasionally minute pustules are intermixed with the vesicles, and make the eruption approximate more closely to the description of the impetiginous variety of eczema.

Eczema in its chronic form, which often proves a very intractable disease, (its removal, especially in elderly persons, being attended with great difficulty, and its relapses frequent,) has perhaps not been sufficiently attended to by Bateman.

According to Rayer, who has given an excellent description of it, it may occur as the sequel to any of the acute varieties above described. In it the inflammation often extends deep into the true skin and cellular membrane, giving rise to a thickening, roughness, and inequality of the surface, which becomes fissured and excoriated, and is not unlike a part which has been lately blistered; being raw and moist in some points, and presenting a scurfy appearance from adherent cuticle or dry and foliated secretions in others. It is in this advanced stage of eczema that its identity with the *dartre squammeuse humide* of Alibert is most obvious. The secretion of acrid lymph is uninterrupted, and the itching so intolerable, that the unfortunate patient cannot abstain from tearing the surface with his nails, and thus aggravating and perpetuating the disease.

This state may continue with little variation for months or even years; the cuticle, which assumes a yellowish tinge from the contact of the discharge, being at frequent intervals exfoliated in large patches. The inflammation is liable to frequent exacerbations; and occasionally, after appearing to be almost subdued, it bursts out with increased violence, either on the same place, or in some distant part of the body.

One of the most frequent seats of chronic eczema is about the external ears, and from thence it not seldom extends into the meatus auditorius externus, and thus sometimes induces deafness. In like manner, when it exists on the face, it may spread from the external surface of the nose to the nostrils; and in both this and the preceding case it proves peculiarly obstinate. When seated on the lips, they occasionally become considerably swollen, and we have seen it in this state present an appearance which might in young persons have been mistaken for a scrofulous affection. When it attacks the scalp, it is not unfrequently confounded with tinea. There is great itching. The hair is at first matted together with the abundant discharge, but this, gradually diminishing, is succeeded by a constant furfuraceous desquamation, beneath which the skin on examination is found to be red, shining, and tender.

In its chronic form, eczema frequently manifests itself also on the upper and inner part of the thighs; the scrotum and prepuce in men, and about the external organs of generation and the breasts in females; and in all these situations the itching is most intolerable.

The circumference of the anus is also very frequently attacked with it, simultaneously or alternately with other parts of the body. It often occurs here by an extension of the disease from the scrotum or thighs; but in some of the most obstinate examples it is a strictly insulated affection, confined to the verge of the anus, perineum, and cleft of the buttock; in which situations a serous secretion concreting into thin, laminated, semi-transparent scales, like exfoliated cuticle, takes place at intervals. In these cases it seems often to be connected with dyspepsia and an irregular state of the bowels, the stools being unnatural, and affording evidence of vitiated intestinal and biliary secretion, inasmuch as they are often peculiarly fetid, black, and tenacious, and expelled with so much difficulty, as to give rise to the belief in the existence of a stricture of the rectum. But this difficulty seems to depend merely on a spasmodic state of the sphincter, induced by the chronic irritation in the skin and contiguous portion of the mucous membrane of the rectum; for the patient is at times able to evacuate the bowels freely. The empirical use of bougies in such cases cannot fail greatly to aggravate the patient's sufferings and perpetuate the evil, by the forcible extension of the excoriated parts. The sensation of burning heat and itching becomes greatly aggravated on getting warm in bed, demanding all the resolution which the individual can summon up to avoid scratching and exasperating it with his nails, an operation which in his sleep almost inevitably takes place. The exacerbations to which this affection is liable sometimes alternate and sometimes coincide with those of the dyspeptic affection. It is one of the many examples of the intimate sympathy which subsists between the external outlets of mucous membranes and the more internal and distant parts of their surface. Ascarides sometimes coexist with this disease, and though there is no reason to suppose them capable of producing it, save when a peculiar predisposition exists, they must doubtless tend much to exasperate the irritation and prolong its existence. We have known this affection alternate with small patches of lichen, psoriasis, or eczema on the arms or neck. Sedentary habits, too free a mode of living, especially in regard to the use of wine and malt liquors, and costiveness, are sure to aggravate it. With regard to the treatment of it, little can be expected from local applications; frequent ablution with cold water affords a momentary relief; but it is to great temperance, steady and active exercise, a due regulation of the bowels, and a correction of the vitiated and irritating nature of the alvine discharges, that we can alone look for permanent benefit.

The **diagnosis** of eczema is occasionally attended with considerable difficulty, as cases not unfrequently present themselves where papulæ and pustules coexist with the true eczematous disease; thus allying the case at once to lichen, impetigo, and eczema, and making us wish that the idea of Burns had been acted on, in establishing as an appendix to our present classification a set of composite genera to which those specimens of cutaneous disease which are of a mixed character, and display an affinity to two or more of the simpler forms, might be referred. For the consolation of the student in this department of pathology, we may mention that we have seen the most practised eye puzzled by such combinations; and individuals, who had made cutaneous disorders their peculiar study for years, confess themselves unable to dispose satisfactorily of such examples in any part of our present arrangements.

In the first stage of the affection, when it exists in its simple form, the only diseases with which we are liable to confound it are some of those of the papular kind, and scabies. From the former it may be satisfactorily distinguished by the colour of the minute vesicles, or more certainly still by puncturing them with a needle, and thus demonstrating the fluid nature of their contents. Their subsequent progress, too, is dissimilar. From scabies, or common itch, the diagnosis, especially of the impetiginous form of eczema, notwithstanding what is asserted by professed writers on the subject, we have often found by no means easy. Its preference for those situations where the sebaceous follicles abound—a knowledge of the preceding causes, such as exposure to great heat or other local irritants—the closeness and uniformity with which its minute and acuminated vesicles are distributed,—the accompanying tumefaction—the tingling and smarting rather than itching which attends them—will, it is said, enable us to distinguish it from the scabies, in which the vesicles are more apart—larger and more unequal in size—less transparent, or of a duller colour, and without any inflammation at their base,—intermingled with minute ulcerations and small dark scabs—attended with a sensation of simple itching—and, finally, occupying chiefly the intervals of the fingers, the wrists, and the flexures of the articulations generally.

The presence or absence of a contagious quality, and the effects of treatment, which are usually dwelt on as points of distinction, are not very creditable grounds on which to form our diagnosis. To discover the nature of a disease when it has been already cured, or when it has spread to other persons in consequence of our incompetence to decide on its true nature, is not satisfactory to any of the parties concerned.

A complication of itch and eczema is not an impossible occurrence, and of course must present much difficulty. Indeed, we have heard of such cases by which the medical attendants were greatly embarrassed, till in the frequent handling and examination of the parts they have themselves contracted scabies, and thus become fully convinced of the existence of at least one part of the disorder.

The miliary eruption may be easily distinguished by the constitutional symptoms which precede or accompany it; and simple erythema, by the absence of all feeling of roughness such as characterizes eczema rubrum even in its early stage, and depends on the elevation of the nascent vesicles. Inattention to this circumstance has led some writers improperly to describe the eczema mercuriale as a species of erythema. Impetigo is sometimes distinguishable with difficulty, if at all, from that species of eczema in which pustules present themselves. The existence of pustules from the very commencement, and the greater thickness and prominence of the crusts, belong more especially to the former. In a practical point of view, however, their diagnosis is not very important. It is often far from easy to distinguish psoriasis of the scrotum and penis from eczema of the same parts when in its advanced and scaly stage: the greater thickening and hardness of the integuments in the former, and the fact of vesicles or humidity never having been present, will aid our diagnosis. When eczema has existed a considerable time, its red, chopped, and scaly surface approximates closely to the appearance of lichen agrius. But even when vesicles no longer exist, as is the case in the more advanced and drier stages of eczema, minute disseminated scaly points will frequently show their former seat, and disclose the true nature of the disease. Eczema of the breast and nipple in its scaly stage, which it has generally attained to before we are consulted, presents to the eye merely a collection of thin and generally yellowish crusts, and is accompanied with a burning itchiness; at this period we shall in vain search for vesicles. Chronic eczema, indeed, in its later periods, when it has passed into a scaly state with numerous erosions and ulcerations, is scarcely recognizable at first sight, even by the most experienced eye. It is to the history of the case that we must here look for decisive information.

In what we have said of the diagnosis of this very frequent and very distressing cutaneous affection, we have been actuated by a desire to represent it in all its true difficulties; as we know that the most zealous students often turn with disgust from the investigation of diseases of the skin, upon finding these difficulties so infinitely greater than they are represented in books, and begin in despair to suspect that they want the tact necessary for their successful study. When made aware of the obscurity which they often present even to the most experienced, this cause of discouragement will in some degree be done away with.

The **prognosis** of the acuter forms of the disease, especially when they depend on some obvious cause of local irritation, is generally favourable. In those cases where the mercurial eczema has assumed its most formidable aspect, the danger has been attributable probably not so much to this affection in itself as to the cachectic habit of the patient, exhausted by previous and co-existent disease as well as by the profuseness of the discharge. In the majority of those instances where chronic eczema is very obstinate, and where the most carefully adapted local treatment has proved unavailing, we should be led to suspect that there is something materially wrong with the state of the general health. We have seen such cases which had existed for years, and resisted for nearly as long a time the most judicious and energetic topical measures. In the aged it is peculiarly unmanageable, and a cure often almost hopeless. Alibert speaks of the *dartre squammeuse humide*, in its aggravated form, as one of the most obstinate and insufferable diseases to which humanity is liable; the irritation which it keeps up, and the despondency which innumerable relapses tend to generate, having in some instances, according to him, led the unfortunate patient to the commission of suicide.

Treatment.—The introduction of the soothing plan of treatment constitutes the most remarkable improvement which has taken place in regard to the management of the cutaneous diseases in these latter times. In mild cases, if we can succeed in subduing for a time the irritation which exists, nature will often do the rest, and re-establish the natural actions of the part. In no class of these diseases are soothing measures more called for than in the vesicular forms, in which the inflammation is usually characterized by considerable acuteness and a high degree of irritation. This is peculiarly the case with some of the varieties of eczema.

Great relief may usually be afforded by frequent ablution with tepid water or mucilaginous decoctions, as those of bran, marsh-mallows, poppy-heads, or of gruel or milk and water; by mild poultices, with or without the addition of goulard, and by local and general tepid baths. Mr. Plumbe condemns in strong terms the use of ointments, and recommends the employment of the common spirit-wash in incipient cases. Lotions containing prussic acid have been found to have much influence in allaying the pruritus. When the patient is young and of a sanguineous temperament or plethoric habit, venesection should not be neglected, and leeches and cupping in the vicinity of the disease are most important auxiliaries. The diet should be light and very sparing. Bateman recommends the use of bark and serpentaria, but on no very clear indications. Mild diluents, gentle laxatives, and the use of the vegetable or mineral acids, are generally all the internal medicine necessary, especially in the acuter and more rapid forms of the affection. As to the propriety of the employment of acids, so usually recommended in cutaneous disorders, we might, if guided by theory alone, have some doubts; for in certain habits, as has been remarked by Sir A. Carlisle, they of themselves occasionally excite much irritation in the skin. Thus many people are affected with pimples shortly after taking them, together with burning heat in the face and itching over the whole body. Yet here, as elsewhere, preconceived notions with regard to the propriety of a therapeutic agent in disease, derived from a knowledge of its influence in a state of health, must not be put in competition with the practical results of experience, and we have certainly seen very troublesome cases of eczema yield rapidly whilst acid drinks were used. The mineral acids (sulphuric and nitric) seem, indeed, to have considerable influence in the later periods in diminishing both the exudation and the itching of the affected parts; whilst in the earliest and most inflammatory stage those of the vegetable kind, on account of their cooling properties, perhaps deserve the preference.

In the mercurial eczema, if its attack be violent, Biett, we believe, never omits the precaution of taking blood from the arm, as the best means of obviating or moderating those symptoms of irritation in the mucous membranes of the respiratory and digestive organs which occasionally complicate it. Pearson recommends the use of diaphoretics; but the irritable state of the stomach and bowels frequently renders them improper: and in those very rare cases where typhoid symptoms supervene, the employment of bark will often, for the same reason, be found inadmissible. Opiates have very usually been recommended by way of allaying irritation and procuring sleep, but their exhibition requires much circumspection, as opium has occasionally been known, in this as well as in the healthy state of the skin, to induce severe itching: and Dr. Moriarty met with one case in which it apparently was the cause of a relapse. The daily use of the tepid bath usually affords much relief by removing the secretion and keeping the surface pliant. Where, however, the excoriations are very extensive, even the tepid bath cannot well be borne, and the effort of getting in and out of it causes much suffering. The heat of the bath must be carefully regulated, for if of too high a temperature, it will inevitably aggravate the inflammatory tendency in the cutaneous surface. The pain caused by the rigidity and contact of the incrustations may be in some degree alleviated by the application of the linimentum calcis. Repeated changes of the linen are indispensable, and will sometimes, from the abundance of the secreted matter, be necessary as often as three or four times in the course of one day. The return to mercury in these cases is to be avoided if possible; as even its mildest preparations have occasionally induced a recurrence of the disease, an effect which took place in a case recorded by Dr. Crawford, from the incautious application of citrine ointment to the still morbid skin. In some urgent cases, however, mercury has been again exhibited, and with impunity.

When eczema has become chronic, the local treatment should still in almost every case be of the soothing kind. Hence a steady perseverance in the use of tepid mucilaginous decoctions, of lotions containing the acetate of lead, of local and general baths, continues, as in the first stage, to be proper. General and local bloodletting and other *antiphlogistic* measures will still often afford us most valuable assistance in subduing this obstinate affection; the propriety of their employment and repetition being of course determined by a joint consideration of the state of the constitution and of the local inflammation in each individual case. We cannot, however, help thinking that, in this country at least, the utility of these measures has, till within these very few years, been greatly overlooked, and that their employment, even at the present moment, is quite too infrequent. This may perhaps in a great degree be attributed to their never once being alluded to by Bateman, whose bias seems to have been altogether towards the opposite mode of treatment, or the frequent exhibition of tonics. His prepossession, too, against the use of aperients in eczema is not justified by the experience of others, as they are often found to be highly beneficial. We have known very severe cases yield to the combined employment of baths, mineral acids, and laxatives. When these and the other measures detailed above disappoint us after having been fairly tried for at least three or four months, recourse may be had to the cautious use of Fowler's solution, or of tincture of cantharides. Amongst Biett's numerous cases under the influence of those powerful medicines, we do not recollect to have seen them ever do mischief; and hence we participate fully in the sentiment with which he frequently prefaces their prescription, namely, that no medicine, however active, is dangerous in prudent hands. Mucilaginous and diluent drinks enter largely into all his plans of treatment, and must tend materially to obviate the danger of gastric irritation during the use of energetic internal medicines. Whether the beneficial influence which arsenic and cantharides often display depends on their immediate action on the skin, or whether it is attributable to their effecting a species of counter-irritation on the mucous membrane, and a consequent equalization of the circulation in the cutaneous and mucous surfaces, is utterly unknown. Their great power as modifiers of the actions of the skin is, however, indisputable. The exhibition of fractional doses of the corrosive sublimate also, given in a decoction of dulcamara, occasionally effects a cure where other measures have failed.

Caustic applications, as the nitrate of silver or diluted muriatic acid, have sometimes been used, as is mentioned by Rayer, with a view to changing the mode of irritation in the part; but they are not unattended with risk, and violent exacerbations and deep cicatrices have resulted from their employment. In the advanced scaly stage stimulant applications have sometimes been of use, by exciting a more active inflammation, and thus subverting the existing morbid action. Ointments containing the red precipitate or tartrate of antimony, and blisters have occasionally been had recourse to with this view, and with success; but the practice is rather empirical, and the result dubious. In an indolent and scaly state, alkaline and sulphur baths may perhaps sometimes be useful; but if too early employed, they are sure to aggravate the inflammation, and in the great majority of cases the vapour bath is to be preferred to them.

When there exists any obvious derangement of the general health, little improvement need be expected till this state be first counteracted. Country air and a careful regulation of the diet are here points of the first importance; alterative doses of calomel or blue pill, with the decoction of sarsaparilla, will sometimes also be of great service. In those cases where there is a marked inflammatory diathesis, indicated by a full pulse, heat of skin, thirst, headach, drowsiness, &c., Dr. Elliotson has found much benefit from mercurial medicines, given so as slightly to affect the mouth, in conjunction with venesection and a low diet. Such a mode of employing mercury, in a disease of which it is itself an occasional cause, will, however, demand great circumspection.

The use of water-dressings, in preference to all ointments and greasy applications, has long been zealously advocated by Dr. Macartney, who has directed much of his attention to the study of diseases of the skin. Indeed the beneficial effects which may be produced in this and several other cutaneous inflammations, merely by keeping the inflamed part constantly moist by means of lint wetted either with cold water or a weak solution of the acetate of lead, and enveloped in oiled silk, are unquestionable and striking. We do not, however, think that the employment of ointments is in all cases injurious, having known eczema of the ears and face, though attended with extreme irritation, receive immediate relief, and get speedily well under the use of an ointment composed of cold cream and the liquor plumbi acetatis in the proportion of two or three drops to the ounce, in conjunction with the repeated application of a cooling lotion, consisting of the acetate of ammonia, accurately neutralized, largely diluted, and holding a minute portion of the acetate of lead in solution.

If the disease have existed about the face for a considerable time, an issue or perpetual blister to the nape of the neck or the arm effects a useful counter-irritation, and will thus often tend both to accelerate the cure and to prevent a relapse. A free state of the bowels and a frequent use of the bath seem also to have much influence in guarding against a recurrence of the affection.

The propriety of a cooling and sparing diet throughout every stage of the disorder, and even for a considerable time after its disappearance, cannot be too strongly insisted on.

W. B. Joy.

EDUCATION, PHYSICAL. Education, in the ordinary acceptation of the term, refers only to intellectual and moral cultivation. Mr. Locke, however, has taken a wider and juster view of the subject, and in his excellent Treatise inculcates strenuously the attentions necessary for preserving and strengthening the bodily constitution. This branch has been denominated *physical education.*

If medical science effect something more than the mere adaptation of remedies to a few special diseases; if it embrace the more enlarged and comprehensive purpose of promoting general health, and preserving the bodily frame in the full and vigorous exercise of all its functions, then is the subject of physical education entitled to a prominent place in every work which professes to treat of the science, or to display its most useful applications. No applications of its principles can be more useful than those which regulate the physical management of the young; for even in infancy, and still more when childhood passes onward to adolescence and puberty, are errors of ignorance and prejudice daily committed, which sow deeply the seeds of disease, consigning many a sufferer to an early grave, or entailing miseries which render life a burden rather than a blessing. However difficult it may be to correct the manifold errors by which, in early life, health and happiness are sacrificed, it must at least be right to point out to those who wish to learn, what are the principles by which the first of earthly blessings, a sound mind in a sound body, can be best insured. With bodily health, mental is here associated, for the connection is intimate: if the body languishes, the mental powers, which act only through bodily organization, must fall far short of that energy and activity of which they would otherwise be capable; while the irritability of mind to which weakness and ill health are prone, is sure to act unfavourably on all the moral feelings. In the present article the design is to lay down principles rather than rules; for the latter never can be so framed as to admit of universal application, and when indiscriminately used, they either, through necessary variableness of effect, fail to inspire confidence and in time fall into disuse, or the good which they do accomplish is sure to be balanced by a portion also of evil. To lay down principles is the safer and better course, for though physiological truths are what few even among the most intellectual classes of society are prepared to comprehend, their education unhappily leaving them utterly unacquainted with the structure and functions of their own frames, still the dissemination of these truths, especially in connection with a subject of such deep and universal interest, may not be wholly unavailing, but may rather prove the means of exciting enquiry, and of dispelling that ignorance to which so much of the ill health of every period of life may be distinctly traced.

Man, in his relation to external objects, is subjected by nature to certain laws; in other words, there exist between man and the external world certain definite and immutable relations, as obligatory as a positive ordinance. If the relation be disregarded, the law violated, the penalty ensues with a certainty that cannot be evaded. It is well, then, as all are subjected to these laws, are capable of acting in conformity with them, and sure to suffer when betrayed, whether by ignorance or wilfulness, into infringing them, that some consideration should be bestowed on them, in order that errors of ignorance at least may have some chance of being avoided.

The natural laws which connect man with the objects around him have been appropriately classed under three heads; namely, the physical, organic, and moral. Vitality confers no exemption from the laws of matter and motion. To these the human body is subject equally as if it were not endued with life. It is true that, while animated, it possesses to a certain extent powers capable of modifying their operation; still it never ceases to be under their influence, and it is liable to suffer whenever that influence is overlooked or miscalculated. The body gravitates, and when deprived of support falls to the ground, equally as if it were inanimate. Physical laws, therefore, are worthy of consideration, in order that no injury may accrue from their violation. But animated bodies are subjected to laws peculiar to themselves; and as life is always connected with organization, these laws are called organic. It is with them that we are more immediately concerned on the present occasion. Man, however, is not only an organized and animated being, but also a moral and intellectual one; and is, in consequence, subject to further laws in relation to this part of his nature, namely, the moral. As his moral and intellectual powers, however derived essentially from his spiritual nature, are dependent on organization for their exercise and manifestation; as the several powers act interchangeably on each other; and as a close analogy resulting from this connection subsists between the organic and moral laws, it will be necessary to take some notice of the latter in the following pages.

The organic laws may be subdivided according as they regard respectively the preservation of the species and of the individual. The former of these may here be passed over as not essential to the present purpose, the preservation of the individual being that which chiefly claims attention in discussing the principles of physical education.

The animal body is connected more immediately with the external world by digestion and respiration, it being through these processes that it derives the elements by which it subsists. Food and air are indispensable so long as life endures; and if either be withheld, or depraved in quality, or too scantily supplied, the animal languishes and prematurely dies. Other elements are most probably combined; there being reason to believe that the electric conditions of the atmosphere exert an influence on the animal economy neither slight nor unimportant. We know too little, however, on this subject to make it the groundwork of any reasoning.

On the regulation of diet much of the health of the body depends. All animals are destined by nature to feed on particular aliments, for digesting and assimilating which they are furnished with an appropriate organization. Some are herbivorous, some graminivorous, some carnivorous. Man being by nature omnivorous, a mixed diet of animal and vegetable food is best fitted for his adequate nutrition, being most accordant with his organization; and this fact ought to serve as a sufficient reply to all those who decry either animal or vegetable diet. The proportions best suited for supporting perfect health must ever vary in individual instances, being dependent on age, temperament, habits of life, state of health, climate, season of year, and other incidental circumstances. The general principle being clear, sufficient ground should be specially shown whenever it is deemed necessary to depart from it, or to modify its application. To display the properties of the several articles of food, both animal and vegetable, is the province of dietetics. (See DIETETICS.)

The quantity of food deserves as much consideration as its quality. It should be such as the stomach can easily digest, and sufficient to repair the waste which the body continually undergoes. In the young, too, it should provide for the growth of the body, which in them is, up to a certain age, progressive. Deficiency of sustenance leaves the body imperfectly nourished, checks its natural growth, and begets various diseases marked by debility. Excess, on the contrary, promotes inordinate nutrition, induces corpulence, oppresses all the functions of life, and through the various efforts made by the constitution to dispose of or to get rid of it, lays the foundation of by far the greater portion of human maladies. In the functions more immediately essential to mere animal existence, nature influences by feelings antecedently to any exercise of reason, and, with respect to the nutrition of man, has given him appetite both to incite him to take food, and to assign a limit to his use of it. A healthy stomach, supplied with simple diet, will, if the intimations of appetite be heeded, be rarely guilty of excess. But though the stomach is thus satisfied, and the natural appetite ceases, it is still capable of taking more food, and even of digesting it. Viands tempting to the palate will incite a fresh appetite, under which the quantity of food required for health, and which consistently with health ought not to be exceeded is often more than doubled. Pampered with luxuries, and rather *living to eat* than *eating to live*, numbers become slaves to a sensual gratification of the lowest kind.

Excess is the vice rather of adults than of the young, who are rarely either gourmands or epicures, unless through the fault of those who rear them. The law of temperance, however, is common to all, and, however it may be disregarded by the inconsiderate or the sensual, cannot be violated with impunity.

Co-ordinate with nutrition, in its being essential to animal life, is respiration. It differs in one respect, that while food is required only at intervals, appetite being the natural incitement and measure of quantity, air is necessary every moment; and as the process goes on uninterruptedly, no incitement of appetite is needed for inhalation of air. The capacity of the lungs, too, being definite, no intemperance can be practised; and with regard to this function it is quality rather than quantity that requires to be attended to. This, however, is of the very first importance; for if pure air be not breathed, health cannot be preserved. Of injury from impure air the young are peculiarly susceptible, and this requires to be attended to in many parts of their ordinary management.

Next in importance to food and air, as a means of maintaining health and vigour, is exercise, which is to be considered not merely as it regards locomotion, but as applying to all the actions of the animal frame which minister to existence, and by which the several functions are sustained. The actions immediately essential to existence are, happily, independent of the will, and are thus secured against the effects of indolence or caprice. Respiration, though not wholly an involuntary process, is so far independent of the will for its ordinary exercise as to continue uninterruptedly, through the whole period of life, without effort and almost without consciousness. Thus circumstanced, and secured as its organs are by their compact and admirably constructed mechanism, it might be conceived that this process at least might escape the evil influences of heedlessness or error; yet no function of the frame has suffered more from the pernicious effects of folly and fashion, effects the reality of which it would be difficult to credit, were it not attested by woful experience and daily observation. Circulation, too, is independent of the will, its organs being excited sufficiently to ensure the regular continuance of their actions, by the fluid which digestion supplies and which respiration vitalizes. Yet here, also, though nature has provided for the regularity of this function, and rendered it independent of direct interference, man contrives indirectly to disturb it by over-excitement through excess of nutritive matter and abuse of various stimulants. So far is the body ensured against the neglect or imprudence of the individual, that what is absolutely necessary for existence is carried on by the mere incitement of appetite, and through actions in which the will has no share. But though mere existence is thus capable of being maintained for a while with little effort, voluntary exertion is still necessary for giving even to these independent functions the activity necessary for healthful vigour. Unless exercise, in its ordinary sense, be taken, neither respiration nor circulation can fully accomplish the purposes which they are intended to serve; and proportional decline of health and strength must ever ensue. Exercise conduces to healthful digestion, perfect respiration, and efficient circulation. Neglect of exercise weakens the stomach, inducing changes in the digestive processes unfavourable to the formation of healthful chyle; it tends to reduce the capacity of the chest, and thus to render the respiratory process less effective; and it diminishes the actions of the heart and arteries to the extent of suppressing some of the most important functions to which they are subservient, namely, those which take place in the capillary system. For propelling blood duly into *all* the capillary vessels, a certain portion of exercise is indispensable. If this be not taken, some or other of those vessels will be inadequately supplied; and in proportion must their functions decline, while the blood which ought to pervade them is thrown back on the larger trunks, overloading and oppressing the general system.

Life subsists through a series of motions, and all these should be maintained in regular and adequate exercise. If any become suspended, or decline beneath the activity necessary for the due performance of their respective functions, the organs shrink, and more or less impression on the general health ensues, according to the importance of the parts consigned to quiescence. If there be total suspension, the organ then undergoes changes wholly subversive of its character and functions. A vessel which ceases to convey its proper fluid becomes soon changed into a solid cord. Muscular fibres, if consigned to inactivity, waste progressively, with proportional loss of power, until at length they approach the state of simple membrane. The laws of muscular action require that the muscle, in order to retain even its natural structure, must be continued in the adequate exercise of its natural functions, else it declines both in volume and power, and all the functions to which its actions are subservient, become impeded in consequence.

The foregoing sketch, though brief and imperfect, may suffice to show what is meant by referring to the natural laws. The subject, however, is not yet sufficiently matured for an elementary exposition of the whole of them, and at all events the writer of the present article is unprepared to attempt it. Whatever remain, therefore, applicable to the present purpose, must be left for the occasions which in the course of this essay may call for their introduction.

In pursuing the subject of physical education, the period of life to which it applies may be divided into the consecutive stages of Infancy, Childhood, Adolescence, and Puberty. The distinctions are sufficiently intelligible without assigning exact limits to each. To do so by a division of years would conduce but little to precision, for individuals differ so much, that similar ages do not necessarily indicate corresponding stages of development either in bodily or mental powers.

Infancy.—The management of infants has been much improved in modern times, and many hurtful prejudices have been utterly extinguished. None, at least in this country, even of the most ignorant, deem it necessary at the present day to swathe the infant's body so as to deprive its limbs and head of all free motion, as was long the universal practice, and in some countries, even of Europe, continues to be so. The infant is now suffered to enjoy the unrestrained exercise of its muscular energies so far as its limited powers of exerting them permit. This was a great emancipation, and conducive not only to physical but also to moral improvement. The exercise of every natural power is accompanied with pleasurable feeling, and, without resorting to metaphysical refinements, it may, from a close analogy, be averred that the infant is sensible of pleasure from the free exercise of its motive powers, and suffers pain from their restriction. These sensations excite moral emotions, and without any great stretch of imagination, it is possible to detect the dawning of an irritable temper at a period of life when a moral feeling is scarcely supposed to exist, and to trace its development to irritations which enlightened caution might prevent. Even at this early period the moral laws are not to be disregarded. These laws pronounce that moral feelings no less than the physical powers acquire force by exercise, and that the surest way of weakening those which, when tending to excess, lead to evil, is to consign them as much as possible to quiescence. Great care is therefore necessary not to arouse angry passions, and especially in infancy, when the other moral feelings, and the intellectual powers by which they are in later years controllable, are too imperfectly developed to be of avail. The principle is applicable to every period of life, and the interesting stage now under discussion should have the full benefit of it.

The present occasion does not call for minute details of the management of infants, which are so familiarly known and so much under the guidance of competent advisers, being for the most part regulated by enlightened medical attendants, that a few general remarks may here suffice. They may be comprised under the heads of clothing, food, state of bowels, air, temperature, cleanliness, exercise, moral discipline, and habits.

Clothing.—The clothing of infants should be soft in texture, so as not to irritate their tender skin. It should be made so as to give free play to all the limbs, no part being subjected to constriction or undue pressure, and should also be so simple as to admit of being quickly adjusted. The process of being dressed is irksome to most infants, causing them to cry, and exciting as much mental irritation as they are capable of feeling. It should, therefore, be rendered as brief as is compatible with the ablutions required, and with the necessary adaptation of the garments to their several purposes. By a very little ingenuity they may be so constructed as to be put on and removed with little delay. It would be well if pins could be wholly dispensed with, their use being hazardous through the carelessness and stupidity of nurses, and even through the ordinary movements of the infant itself. Soft tapes, loops, and buttons, hooks and eyes, or other such fastenings, might be beneficially substituted.

Food.—That the infant should derive its earliest sustenance from the mother's breast was so obviously designed by nature, that the abstract propriety of mothers suckling their offspring admits of no dispute. The question, however, whether all mothers should discharge this duty is not thus determined, the condition of the mother and her capability of performing it requiring to be taken into account, as well as the wants of the child. When a mother is young, healthy, and sufficiently robust, it is her bounden duty, as it ought to be her dearest pleasure, to foster in her bosom the being which she has brought into existence, and to nourish it with the food expressly provided by nature for its use. Every consideration, both physical and moral, pleads for this exercise of maternal function. By it the bodily health of both mother and child is promoted, while it excites in both the purest emotions of the heart.

All mothers, however, are not capable of performing this duty; and, unfortunately, among the higher and middle classes of society, a considerable portion, through errors of physical education, and the debilitating effects of various pernicious practices proceeding from fashion, luxury, and dissipation, are incapacitated for undertaking it. Thus error perpetuates itself, and in its natural consequences comes to act in a circle. The dissipated mother neglects her child, and this child, if a female, commences life under disadvantages which, by weakening her frame, tend to unfit her for eventually acting as a mother. Extreme delicacy of constitution, diseased condition of the frame, defective secretion of milk, may forbid the mother to suckle her child. Unless she can perform the duty with safety to herself and benefit to her infant, she ought not to attempt it. In this case a young and healthy wet-nurse is the best substitute. But even this resource is not always attainable, and then it is consolatory to reflect that children may be reared without material prejudice to health, by what is termed feeding by hand, though extreme care is requisite to make the substitution effectual. In this case the process of nature should be emulated as far as possible, and food should be imbibed by suction from a nursing-bottle, rather than swallowed from a spoon. Much injury results from giving infants food too gross for their digestive powers. If nursing by hand, as it is termed, be resorted to, the food, for the early months at least, should approach as nearly as possible to human milk. Milk and water, with a little sugar, is quite enough for the first two months. After which some farinaceous matter may be combined. Thick gruel, panada, biscuit-food, and such matters, are much too solid, at least in very early infancy. They overload the stomach, causing indigestion, flatulency, and griping. These create a necessity for purgative medicines and carminatives, which again weaken digestion, and by the unnatural irritation perpetuate the evils which render them necessary. Thus many infants are kept in a continual round of repletion, indigestion, and purging, with the administration of cordials and narcotics, who, if their diet were in quantity and quality suited to their digestive powers, would need no aid from physic or physicians.

The frequency with which medical aid is required for infants under gastric and intestinal disturbance, and the numerous infantile maladies which spring from this source, are sufficient proof that their ordinary diet is not as rational as it might be rendered. From errors of diet are the digestive functions of infants chiefly, if not solely, liable to be impaired, and, when these become so, correction of diet, rather than the exhibition of drugs, should be relied on for remedying the evil. We are far from inculcating that on such occasions medical advice should not be resorted to; on the contrary, our persuasion is, that, when such disturbance arises, medical counsel is absolutely necessary, as the medical adviser is more likely to see the real nature of the evil, and adopt rational means for its correction, than they whose injudicious proceedings occasioned it. But we would strenuously advise the medical attendant to be sparing of his drugs, unless he see adequate cause for exhibiting them. We are well aware that, even in infancy, the bowels may become loaded, and their lining membrane coated with redundant mucus, and that purges, even of calomel and antimony, with rhubarb or scammony, may be required to cleanse them, and restore healthy secretion. But such remedies should not be prescribed on every trivial occasion, and at all events a succession of such drastic purges can very rarely be needed. The stools, if rightly understood, will furnish a sufficiently certain guide. If there be evidence of redundant and vitiated secretion, and if the removal of this by purgatives relieve pain and restore tranquil feelings, no doubt can attach to the means by which these effects are obtained. But it sometimes happens that some tinge in the fæces, some incidental pain, misleads the practitioner, inducing him to believe that more purging is needed, when the prevailing distress may be owing to the irritation caused by the purgatives already too freely administered. In this case he will do well to pause, and, by abstaining from interference, suffer the bowels to recover the tranquillity which his remedies serve to disturb. It is a valuable part of medical science to know when to resolve on doing nothing, and an excellent result of moral courage to dare to act on that resolution. On such occasions it is not true that medical skill is at fault or in abeyance. It only evinces the sagacity to perceive that nature is competent to her own work, and that she ought not to be interrupted in completing it.

In judging of the intestinal secretions of infants, there is a source of fallacy which deserves to be noticed. Mucus accumulates on the lining membrane of the stomach and bowels, and becomes morbid, inducing disease. The irritation of purgatives, too freely given, will also cause an increased secretion of mucus manifested in the stools. The matters discharged, however, are very different in their nature, and can hardly deceive an experienced eye. In the former case, the mucus is opake, dense, ropy, or membranous; in the latter, it is limpid and fluid. Purgatives relieve the former condition; they exasperate the latter.

Infants naturally have free bowels, and, if properly fed, they need no medicine. Even in purging off the meconium, art is often superfluously resorted to, or at least prematurely employed. The first milk of the mother's breast is the natural purge, and oftentimes even this is not required. A too early exhibition of castor-oil, as is very generally practised, is unwise. A little manna is less irritating, and will in general suffice. Simple suppositories were formerly much in use, and perhaps they have been too much laid aside. When distress, however, arises from distension or flatulency under retention of the meconium, some aperient is needed, and, for certainty of effect, castor-oil is perhaps most to be relied on. With respect to the general management of the bowels of infants, the principle is that they should be kept free, and by the mildest and least irritating means. This is all that health requires. It may be finally remarked, however, that no course of proceeding can be more prejudicial than, having first overloaded the stomach and then administered purgatives, followed by carminatives and narcotics, to return to the dietetic errors which created the necessity for all this discipline.

Air.—It is of importance that children should breathe a pure atmosphere. During the day this is in general sufficiently attended to; but at night they are very apt to be placed under circumstances unfavourable to a free circulation of the air around them. Apprehension of cold causes them to be then more closely enveloped with clothing, especially about the head; curtains are drawn in order to exclude cold air; nay, through extreme care, a thin covering is not unfrequently thrown over the face of a sleeping infant, confining the respired air, and impeding the access of fresh air required. All these practices are bad, and ought to be avoided. The head should not be muffled, curtains are objectionable, and the face should not be covered during sleep. Pure air is needed, and a supply of this should be ensured without giving way to undue apprehension of cold, of which the danger is very slight, unless great imprudence be practised. Infants should be guarded from cold, but much heat is prejudicial. On this as well as on several other accounts, the child should not lie in the bed with the nurse. After having sucked, it should be placed in a cradle with just so much covering as is necessary for preserving the natural temperature.

Cleanliness.—Cleanliness is essential to the health of infants, the functions of the skin being of high importance, and requiring to be kept in due activity. The body should be washed all over once a day at least, and impurities should never be suffered to remain for any time in contact with the skin. At first the water used should be tepid, but after a few months the temperature should be gradually lowered, until cold be employed, unless there be such extreme delicacy and deficient re-action as to render this hazardous. Children bear well the transient application of cold, which is in general succeeded by a genial glow, both refreshing and invigorating. Many weakly children are renovated in health and strength by means of a daily plunge in a cold bath.

Exercise.—Infants, for the first month or two, sleep so much that there can be no exercise, save that of being carried about in the nurse's arms. After this time it is advisable to suffer them to exercise their limbs freely, by laying them frequently on a bed, sofa, or carpet, and allowing them to roll and kick at their good pleasure. The delight which this affords evinces how grateful such freedom is to their animal feelings.

There is one very common mode of exercising infants, which, we think, deserves particular notice—we mean the practice of *hoisting* or raising them aloft in the air. This practice is of such venerable antiquity, and so universal, that it would be vain to impugn it. The pleasure, too, which most children evince under it, seems to show that it cannot be so objectionable as a cursory observer would be disposed to consider. Still there are hazards which ought not to be wholly overlooked. The risk of accident is one of some amount: children have slipped from the hands, and sustained serious injury. Some people are so energetic as to throw up children and catch them in descending. This rashness there can be no hesitation in reprobating, for however confident the person may be of not missing hold, there must ever be risk of injury from the concussion suffered in the descent, and even from the firmness of grasp necessary for recovering and maintaining the hold. The motion of the body, too, has a direct tendency to induce vertigo; and when the liability of the infant brain to congestion and its consequences is considered, when the frequency of hydrocephalus in infants is borne in mind, an exercise which impels blood to the brain will not be regarded as wholly insignificant. There is one more objection which seems not to have attracted attention. The hold taken of a child in the act of hoisting it is by the hand grasping the chest. The fingers and thumb placed on each side of the sternum, compress the ribs, and any one with the hand so placed will at once perceive that if the pressure were strong, and the resistance from the elasticity of the ribs weak, the impression on the chest resulting would correspond exactly with the deformity named *chicken-breast*. That any force is ever used capable of inducing speedily such a change is in the highest degree improbable; but that reiterated pressure of this kind, however slight, would in a weakly child have power to impress and distort the chest, few, we imagine, will doubt.

Rocking was formerly in almost universal use with infants, though not meant precisely as exercise. Every cradle had its rocker, by means of which it was put in vibratory motion whenever the infant was to be set asleep. The expedient answered its purpose; but the propriety of inducing sleep by such means is very questionable, or rather must be utterly disallowed. Sleep here ensues because the motion promotes a congestive state of the vessels of the brain inducing a degree of vertigo. For the reasons already assigned when discussing the exercise of hoisting, this cannot be salutary, and must be scarcely safe in the delicate brains of infants.

Moral Management.—To notice the moral discipline of infancy may excite a smile; and yet it is a subject of no slight moment. From the hour of birth the infant is a moral being, and subject to the moral laws; and it is the duty of those who are responsible for its culture to see that these laws be not infringed. Bodily health, too, being more or less affected by mental excitement, a treatise on physical education would be incomplete if this source of disturbance were disregarded. Infants possess several propensities and passions of great activity; and as neither the countervailing sentiments, nor the intellectual powers by which they are to be controlled in after-life, are at this age equally developed, it is the more incumbent on those who govern them to regulate, on sound principles, the dispositions which they display. Good dispositions are capable of being cultivated, and evil of being restrained, even in the cradle. But they who undertake the task should look well after the government of their own minds; for if in pursuing it they yield to the impulse of feelings, unrestrained by the higher sentiments and unguided by the intellect, their measures will be ill adapted to the ends desired, and little likely to attain them. An irritable nurse is unfit for the care of a fretful child. The fretfulness may be owing partly to natural disposition; it often arises from impaired health, or from slight sufferings occasioned by some injudicious management. Rendered uneasy by overloaded bowels, constriction from the clothing, misplaced pins, or other source of disquietude, the infant has no resource but to cry; and if the cause of distress be not removed, habitual fretfulness and irritability of temper may become established. In a child of natural good temper, when the distress is relieved, calmness returns; but if the temper be naturally irritable, this becomes aroused by the pains endured, and especially if under its sufferings the child be harshly or unkindly treated: so that even when the bodily distress ceases, equanimity is not restored. Children cry from pain; they cry also from passion; and no tones can be more distinct than those which express the respective feelings. The one should be promptly quieted by removing the cause of pain; the other is less speedily corrigible, requiring both time and a system of sound moral discipline, to prevent habits of irritability acquiring strength by reiterated excitement. When the natural temper is irritable, causes of irritation should be carefully avoided; the irritability should be calmly but steadily repressed; other faculties of the mind, too, should be called forth, as indirectly suspending the exercise of the irritable feelings; and according as the mental powers become progressively developed, the higher sentiments and intellectual faculties should be so cultivated as to ensure them that predominance over the animal propensities which the Creator has allotted to them, and on the maintenance of which all virtue and happiness depend. To exercise this controlling power in due time is the greatest good which the infant can experience; it lays the foundation of all moral improvement, and cannot be too early commenced. No error can be more pernicious in its consequences than to be reckless of exciting the passions of children, without considering how they are to be allayed. Some have been so misguided as wantonly to excite such passions in order to habituate the parties to self-control; but this error is so mischievous, and so irreconcilable with all sound principle, that it must be of rare occurrence. Even carelessness, however, in this respect is inexcusable; and no child should be subjected to any irritation that can be avoided. Frequent excitement will, in the naturally irritable, confirm ill temper, while it will endanger the establishment of it, even in those who are naturally more calm. Irritability of temper in children should be regarded rather in the light of a disease to be remedied, than of a fault to be punished. They are as nature made them, and no more accountable for irritability of temper than for a weak digestion or other bodily infirmity. The possession of an irritable temper is a misfortune rather than a fault, and the being so unhappily circumstanced merits pity rather than reproof. All the assistance which kindness and sympathy can render should be given in support of the struggles which such a being has to maintain within his own breast. Imperturbable calmness is required in the government of children, who readily distinguish whether reproof or punishment proceed from excited passion, or are resorted to solely for their correction or improvement. This discussion, however, must terminate here. Enough has been said to mark the close connection that subsists between moral discipline and physical welfare. Tranquillity of mind is essential to good health, and the government of the passions is important towards attaining the ends of physical education.

In rearing children it is necessary to bear in mind the force of habit, by which, in many parts of the animal economy, regularity is maintained with a precision which the dictates of reason could never command. Many of the bodily functions are signally under its influence; and on the principle that activity gives vigour, while quiescence leads to abatement of energy, much of moral discipline may be founded on the formation of habits during those early years when the self-controlling powers of the individual are yet but imperfectly developed. In respect of food, of sleep, of the alvine discharges, a disposition to periodic recurrence is clearly discernible; and by attending to it, regularity of the respective functions may be sensibly promoted. Fixed periods for taking food are desirable, and they should be frequent. It is unwise to load the stomach with fresh food until the previous meal has been digested and passed onward to the intestines. From this error the gastric and intestinal irritations of infancy oftentimes proceed. Regular habits of evacuating the bowels, if duly established, have much effect in superseding the use of medicine. So prone are the bowels to make at certain periods efforts for their own relief, that if from any cause the periodic impulse be resisted, the effort ceases, and is not again actively renewed until the next revolving period arrives; accumulations, productive both of inconvenience and injury, going on during the interval. It seems needless to pursue further the consideration of infancy. What has been said furnishes sufficient guidance for conducting the ordinary management of health, and for guarding against the errors to which this stage of life is exposed. So many of the principles inculcated in the foregoing inquiry apply to the next stage, or that of childhood, that this may be more briefly discussed. [See a Treatise on the Physiological and Moral Treatment of Infancy, by A. Combe, M. D., Amer. edit. by Dr. J. Bell: Philad. 1840.]

Childhood.—In considering the stage of childhood, we shall, for the sake of method, pursue the same arrangement that was followed in treating of infancy, without deeming it necessary, however, to dwell more circumstantially on any point than its merits may specially require.

The clothing of childhood should possess the same properties as that of infancy. It should afford due warmth, be of such materials as do not irritate the skin, and so made as to occasion no unnatural constriction.

On the feeding of children their health is much dependent; and in this respect injury is often done from regulating their diet according to some preconceived system founded on partial experience or imperfect observation. Children, to support their natural growth, require ample sustenance, and this admitted truth is with many a sufficient reason for overloading their stomachs, and with food of too nutritious a kind. Others again, from having seen healthy children reared on a low diet, and, also from having occasionally witnessed disease brought on by excess of animal food, unaware, too, of the hazard of generalising from insufficient facts, hastily conclude that low diet is wholesome, and animal food prejudicial. No exclusive system can in this respect be right, nor can any precise rule of diet be possibly laid down, as this requires to be adapted in every case to the particular constitution concerned. It has been already shown that a mixed diet of animal and vegetable food is that which nature has designed for human beings; their organization being fitted for its use. The period, too, when animal food may begin to be used seems also indicated by nature, and some portion of it seems fairly admissible as soon as teeth appear sufficient to masticate it. These, however, are but general truths, which require continually to be modified in their application by special circumstances. The constitution of the child, and the effects of particular diets, will in general indicate sufficiently how it may be best sustained. If of a sound constitution, free from fever or evidences of plethora, with healthy bowels, a cool skin and clear tongue, the diet may be liberal, and some animal food may be conjoined. It is not wise to stint the growth of children by a too low diet, for, however it may for a while appear to agree, it induces a state of body deficient in vigour and unfit for maintaining full health. Children so reared are prone to scrofula, and to several other diseases marked by impaired energy of frame. Yet neither should children be pampered; for this leads to evils no less formidable, though of a different character. Large meals oppress the stomach, cause indigestion, and by overloading the bowels, obstruct one of the most important excretions. Too much animal food supplies blood in excess, begetting a proneness to fever and inflammation; and every one is aware how large a portion of the diseases of children is thus characterised. So long as the general health is unimpaired, the body and mind active, and no evidence present to mark excess of nutriment, that food may be allowed which natural appetite calls for, and which appears to yield adequate nutrition; and in such case a mixed diet of animal and vegetable food will be found the best for this purpose. But if languor at any time ensues, and febrile indications become manifested,—if the pulse become frequent, the skin hotter than natural, the tongue white and furred, the bowels irregular, — then, though these several symptoms should be only in slight degree, and unattended with any specific derangement amounting to what is considered disease, not only should the diet be lowered, and its animal part for a time withdrawn, but measures should be taken to correct the state of repletion which has been suffered to arise. For some time after its removal, too, care should be taken to keep the diet under that which occasioned the constitutional disturbance.

These observations apply to children of sound constitutions and robust health, and attention to them may be the means of averting much disease. In such the plethora so induced is positive; that is, the blood generated exceeds what the constitution in its most healthful state could need or dispose of. But there is another, and a numerous class of constitutions in the management of which further principles are needed. These are by nature less robust, and, possessing less powers of resisting slight influences, their health becomes more or less impaired. The weakness induced disinclines to exercise; and thus a further source of derangement is superadded. Under these circumstances, the nutritive matter introduced into the system, though not exceeding what the same constitution in a state of health and vigour would require, is redundant under its altered condition. The enfeebled powers cannot dispose of it; and hence arises a state of relative plethora, producing all the evils of the positive, while, from the partial weaknesses that co-exist, it is capable of inflicting still more injury on the frame. It is the *plethora ad vires* of the older writers; and the febrile state which it induces is, like that of the positive plethora, relievable by evacuations and abstinence. But for the restoration of perfect health, something more is needed than merely getting rid of the febrile excitement. Suitable treatment will abate the plethora, remove the fever, and correct the incidental derangements, so as to bring back the constitution to the point from which the occurrence of relative plethora had caused it to deviate, and increased caution in diet may prevent the plethora recurring. But by adhering to this caution, the food required for full health may be withheld, and feebleness of habit becomes established. In this state, while it is necessary to limit the diet so long as evidences of renewed plethora are prone to occur, the necessity of improving the habit, so as to enable it to bear more adequate nutrition, should be borne in mind. Moderating by cautious depletion the circulation when overcharged, preserving a free state of excretions, increasing the exercise, restoring tone by cold ablution or the shower-bath, with other alterations contributary to the same end, will, if judiciously applied and steadily persevered in, restore many such constitutions to a state of vigour capable of bearing the diet of full health, and exempting the parties from manifold diseases to which they would otherwise be exposed. It will be perceived that the measures here enjoined are partly remedial, partly restorative; and it is of the first importance that the right order of their employment be not reversed. If, while the remedial measures are needed, the fear of debility or other prejudice lead to the premature use of restorative means, the whole corrective process is disturbed and rendered impracticable, and disease more or less formidable is sure to result.

Regulation of the bowels is one of the most important attentions by which the health of childhood is preserved. Children of sound health, who are properly fed and have sufficient exercise, will rarely need aperient physic. Nature is fully equal to her own work, and if not obstructed will effectually perform it. Still the bowels of children will occasionally get deranged, and their incidental irregularities cannot be too soon rectified; for, independently of the local distress which a disordered state of bowels occasions, so long as this continues, a most important function of health is suspended, and part of its duties becomes transferred to other organs unfitted for discharging them. Various irritations, too, resulting from nervous sympathy, ensue. To restore a healthy state of bowels whenever these become deranged, is an important part of the physical management of childhood. For this, simple means should be preferred; but if they fail to re-establish regular evacuations with healthy secretions, more active remedies must then be resorted to, the direction of which belongs not to this place.

Children should breathe a pure atmosphere both by day and night. By day they should be much in the open air, and allowed to exercise their limbs freely, short of fatigue. Long walks are objectionable, and a single over-exertion of this kind is capable of doing permanent injury. In treating of exercise we wish to give one caution applicable to that period when the child first attempts to walk. Its early efforts are viewed with so much delight that they are apt to be encouraged and prolonged without regard to the mischief which they may occasion. The bones of infants have little resistance, and time is required ere those of the legs are capable of sustaining the weight of the body. If prematurely subjected to it, they actually bend and become curved; and many an inconsiderate mother has to mourn over the deformity which she has herself created. In the upper classes of society this result perhaps is not frequent. It occurs chiefly to young mothers who have weakly children, and for obvious reasons the first child is most exposed to it. Among the poor it is very common, though their indiscretion springs from somewhat different feelings. With them it is less the indulgence of maternal emotions, gratified by the child's exhibition of strength, that leads to this distortion, than the necessity of confiding very young children to the care of others but a few years older. This distortion, if timely noticed, is capable of correction, even after sensible curvature has taken place. Such children are in general feeble; and renovation of strength with the regular action of the several muscles of the limb may counteract the injury sustained, and cause the deformity to disappear. But to produce this effect the original cause of distortion must be sedulously avoided, until firmness of bone and strength of muscle remove all hazard of perpetuating or renewing the evil. In addition to other means of establishing the necessary vigour of frame in such cases, a daily plunge in a cold bath is of signal efficacy.

It is hardly necessary to enter further into the physical discipline of childhood; nor is it required in this stage of existence to make any distinction between males and females. Happily for the latter, they are, during childhood at least, strangers to those restrictions and injurious practices from which in later years they are doomed to suffer so severely. From this period on to puberty a marked difference prevails in the management of boys and girls, greatly to the prejudice of the latter; and it is to the errors thus committed, and the calamitous evils which they inflict, that attention will be chiefly directed in the following pages.

ADOLESCENCE.—Boys, though oftentimes too much confined by the prevailing systems of school discipline, have on the whole considerable liberty, and they avail themselves of it so as to exert freely and actively their muscular energies. By such exercise their growth is promoted, their vigour improved, their health maintained, and a robustness of frame acquired exceeding that of girls to a degree far beyond what mere difference of sex would account for. Very different is the fate of female childhood as it passes onwards to adolescence. When this latter stage is approached, the trammels of error, prejudice, and false system begin to be imposed, restraining the free exercise of body and mind, and conforming both, not to what reason and right feelings enjoin, but to what fashion and vanity dictate. The body, instead of being suffered to attain its just proportions uninfluenced by interference of art, is to be trained into those forms which the caprice of the day admires, however unnatural, or however unbecoming in the eye of unvitiated taste. The limbs, formed for activity, and requiring free exercise for the development of their structure and the maintenance of their powers, as well as for the preservation of general health, are to be restricted to those movements to which a fancied gracefulness attaches, even though the best powers both of body and mind wither under the blighting influence of the vicious system. The mind fares no better; for instead of the cultivation of those intellectual powers and moral feelings which conduce to utility, happiness, and virtue, the best years of life are wasted on vain accomplishments, which, even when attained, are too dearly purchased, yielding but a very inadequate recompense for the time and toil bestowed on them, and which in a large proportion of instances, from being forced against nature, and without the talents that would justify such assiduous cultivation, are never acquired to the extent of answering a single good purpose, being sure to be abandoned as soon as the parties become free agents, and released from the control of their unrelenting taskmasters. Each of these subjects will require to be considered more in detail; and above all, attention must be forcibly drawn to those horrible ravages in female health that result from the visceral lesions which the tyranny of fashion occasions. To any one impressed with the reality and extent of the evils here deprecated, it is difficult to think or write on them with perfect calmness. We shall endeavour as much as possible to confine ourselves to a plain exposition of the evils deplored, and of these we shall adduce only such evidences as admit of unequivocal demonstration.

Of boys it is unnecessary to say much, as the principles already inculcated apply to them equally as to infants and children. To them the advance from childhood brings but greater freedom; and if the confinement of school exceed what sound reason and the philosophy of nature would sanction, they redeem the mischief by the active unrestrained gambols in which they indulge when school-hours are over. They pass much time in the open air, exercise freely, take food with appetite, and digest it thoroughly; whence the stomach and bowels are seldom disordered, and their sleep is sound and refreshing. Their clothes, too, make no injurious pressure; all their muscles are at liberty to act, and the free exercise of these promotes both their growth and activity, ensuring thus the regularity and efficiency of the several functions to which these muscles are subservient.

With girls, the ordinary modes of proceeding are much less healthful. It is not that their health is less an object of regard, or less carefully tended, but other considerations than those of health obtain an undue share of attention, and various practices subversive of health are pursued in ignorance of the extensive mischiefs to which they lead. After childhood, education formally commences, and from this period certain objects of maternal solicitude are pursued with a zeal and earnestness which, if well directed, would be worthy of all praise. As it is, that of good intentions can only be awarded; for the tendency of much that occurs at the periods of life now under consideration is to render valueless all the cares lavished, by breaking down the constitution.

The first error is that of restraining the free motions of the body and limbs, so natural at this period of life, and in which the young of both sexes so much delight. The young lady is now to cultivate manners, to practise a certain demureness supposed to be becoming, to attend to her carriage, keeping her head erect, and her shoulders drawn back; and if from inability to continue the muscular efforts necessary for this end, she fail to do what nature does not empower her to accomplish, negligence or obstinacy is imputed, reproach is cast, which, being felt as unjust, irritates the moral feelings; and thus a slight error in physical discipline becomes a fruitful source not only of bodily injury but of moral depravation. It is a well-established fact with respect to muscular energy, that the contractions of muscular fibres on which their actions depend, require intervals of relaxation; that, if the contractions be prolonged without this relief, they in a certain time fail, so that no effort of the will can continue them. In other words, the muscles tire, and an interval of repose is necessary to fit them for renewed effort. This is familiarly instanced by the experiment of holding the arm extended, when, even though no weight be held in the hand, the continued muscular action required for maintaining this position cannot be sustained for many minutes. If this be true of the firm and robust muscles of adults, how much more forcibly does the principle apply to the tender and immature muscles of early life! To preserve a good carriage, to keep the head and shoulders continually in that position which the dancing-master approves, require considerable muscular powers, such as no girl can exercise without long, painful, and injurious training, nor even by this, unless other measures to be hereafter noticed, be resorted to in aid of her direct endeavours. We would not here be understood as undervaluing a good carriage, which is not only pleasing to the eye, but is, when natural, absolutely conducive itself to health, as resulting from that relative position of the several parts connected exteriorly with the chest, which allows greatest freedom to the internal organs. To ensure a good carriage, the only rational way is to give the necessary power, especially in the muscles chiefly concerned; and this is to be done, not by wearying those muscles by continual and unrelieved exertion, but by invigorating the frame generally, and more especially by strengthening the particular muscles through varied exercise alternated with due repose. Attention to general health, suitable diet, regular bowels, moderate but regular exercise, not of particular muscles only, but of the whole frame, cold bathing when needed, and other such measures, will maintain a good carriage by giving that power which the more direct means so generally practised served but to exhaust. All this may appear trivial and of slight importance, yet the principle inculcated is far from being so; and it applies to this early stage of life as forcibly as to those more advanced. Nay, more so; it is at this stage that its observance is of greatest moment; for if it be here disregarded, effects may result, which, though not immediately obvious, are capable of laying the foundation of evils that cannot afterwards be redeemed. It is possible that the principle might be more clearly illustrated, more forcibly inculcated in connection with those later periods of life when the consequences of disregarding it are more prominent; but we prefer dwelling on it in its earliest and simplest applications, as a clear conception of these will materially assist in unravelling and comprehending the more complex conditions which are hereafter to be noticed. The evils produced by errors in physical education oftentimes beget actual disease, and the nature of this will ever be more intelligible in proportion as we ascend to the causes which primarily induce it. It has been shown that direct endeavours to enforce what is called a good carriage necessarily fail of their effect, and that instead of strengthening they enfeeble the muscular powers necessary for maintaining it. This fact soon becomes perceptible; weakness is noticed, and instead of correcting this by the only rational mode, that of invigorating the weakened muscles, mechanical aid is called in to support them, and laced waistcoats are resorted to. These undoubtedly give support,—nay, they may be so used as almost wholly to supersede the muscular efforts, with the advantage of not tiring, however long or continuously employed. Improvement of carriage is manifested, the child is sensible of relief from a painful exertion, the mother is pleased with the success of her management, and this success appears to superficial observation fully to confirm the judgment which superintends it. In the present ignorance that prevails on all points of animal physiology, it would be quite impossible to convince any mother so impressed that she was doing otherwise than ministering to her child's welfare. Yet what are the consequences to which her measures tend, and which such measures are daily and hourly producing? It has been shown in the foregoing pages, when noticing the organic laws, that a muscle consigned to inactivity not only loses power, but becomes attenuated and wasted, its nutrition failing from want of that energy which due exercise alone can confer. The fact is notorious, the principle unquestionable, although its application to the case under consideration has been little heeded. The muscles of the back and chest, restrained in their natural and healthful exercise by the waistcoats called in to aid them, and more signally in after-life by the tightly-laced stays or corsets, become attenuated, and still further enfeebled, until at length they are wholly dependent on the mechanical aid, being quite incapable of dispensing with it for any continuance.

At first, laced waistcoats are used rather for the convenience of suspending other parts of the dress than with any view of giving support to weak muscles, or of influencing the shape; and confined to such use they would be perfectly harmless. In time, when weakness becomes inferred, not from any evidences of actual debility, but merely from the girl's not being able to maintain the unnatural and constrained posture which fashion and false taste enjoin, the advantage of compressing the chest by means of the waistcoat, so as to give support to the muscles of the back, becomes discovered, and the mechanical power supplied by the lace affords but too effective means of accomplishing this compression. The effect pleases the mother, promoting, as it does, her dearly-prized object—a good carriage; it is endured by the girl as the lesser of two evils, for though at first irksome, it releases her from the pain of endeavours which she has not power to continue to the extent required. As years advance, various causes combine to render this practice more inveterate and more pernicious; and still the potent instrument, the lace, extends its ready and effectual aid. The extent to which this practice prevails, and the degree to which it is carried, are too notorious to need being dwelt on. Extreme cases we wish not to state, lest they should appear exaggerations; but daily observation displays to all who walk our streets, and still more signally to those who frequent our assemblies of fashion, the many victims who, through tight lacing, sacrifice health, and too often life, at the shrine of empty vanity.

It is time now to scrutinize the further injuries which this unnatural practice inflicts. The first evil is already suffered in the dorsal weakness occasioned by mechanical support having superseded muscular energy. The muscles are become enfeebled and attenuated; their physical condition unfits them now for doing that for which nature designed them; the stays are become indispensable, and, so strong is the faith in their necessity, that a proposition to discard them would be accounted monstrous. A conception that they could be laid aside would be regarded as quite too improbable to be for a moment entertained. But now a taper waist becomes an object of ambition, and the stays are to be laced more closely. This is still done gradually, and, at first, imperceptibly to the parties. The effect, however, though slow, is sure, and the powers of endurance thus exercised come in time to bear almost unconsciously what, if suddenly or quickly attempted, no heroism could possibly sustain.

The derangements to which this increased pressure gives rise must now be considered. The first is the obvious impediment to the motions of the ribs which this constriction of the chest occasions. For perfect respiration these motions should be free and unrestrained, and, as has been already noticed, perfect respiration is necessary to those changes in the blood which fit it for nutrition and the other purposes of the animal frame. In proportion as respiration is impeded, is the blood imperfectly vitalized; and in the same ratio are the nutrient and other functions dependent on the blood inadequately performed. Here, then, is one source of debility which affects the whole frame, reducing every part below the standard of healthful vigour. According, also, as each inspiration of air becomes less full, the wants of the system require, as a compensation, increased frequency; and thus quickened respiration commences, disturbing the lungs, and creating in them a tendency to inflammatory action. The heart, too, becomes excited, the pulse accelerated, and palpitation is in time superadded. All these effects are capable of resulting from mere constriction of the chest; they become fearfully aggravated when, at a more advanced stage, as will be more fully shown in the sequel, additional sources of irritation arise in flexure of the spine, and in derangements of the stomach, liver, and other organs subservient to digestion. The foregoing disturbances are formidable enough, and sufficiently destructive of health, yet they are not the only lesions which tight lacing induces. The pressure, which is chiefly made on the lower part of the chest, and to which this part most readily yields, extends its malign influence to the abdominal viscera also. By it the stomach and liver are compressed, and, in time, partially detruded from the concavity of the diaphragm, to the great disturbance of their functions; and being pressed downwards, too, these trespass on that space which the other abdominal viscera require, superinducing still further derangements. Thus, almost every function of the body becomes more or less depraved. Nothing could have prevented the source of all this mischief and misery from being fully detected and universally understood, but the slow and insidious process by which the aberration from sound principle effects its ravages; and on this account it is that we lay so much stress on the remoter evils when considering the primary errors, for it is only by tracing those to their source, and by connecting the several visceral lesions which ultimately take place with the incipient and apparently harmless errors which form the earlier links in the chain of causation, that any hope can be entertained of those evils being clearly understood or effectually rectified.

It must be seen that the same principles apply to every stage of this destructive system, and that, however insignificant the effects of the early waistcoats may appear when compared with those of the tight-laced corset, the same false principle is manifested throughout. The girl's waistcoat, if used otherwise than as a support for the other articles of dress, is improper. When tightened in order to support the back, instead of giving strength, it produces real weakness by the effect on the dorsal muscles already described; and when further straitened, so as to diminish the waist, it then commences that suicidal process which years of suffering and ill health are afterwards to complete.

But there are further evils yet to be noticed. The mere weakness of back, so often adverted to, becomes in its turn an aggravating cause of visceral lesion. The body cannot be always cased in tightly-laced stays; their pressure may be endured to any extent under the excitement of the evening display, but during the day some relaxation must take place. Under it, the muscles of the back, deprived of their accustomed support, and incapable of themselves to sustain the incumbent weight, yield, and the column of the spine bends, at first anteriorly, causing round shoulders and an arched back; but eventually inclines to one or other side, giving rise to the well-known and too frequently occurring state of lateral curvature. This last change most frequently commences in the sitting posture, such females being, through general debility, much disposed to sedentary habits. As soon as lateral curvature commences, the lungs and heart become still more disturbed; anhelation from slight exertion, short cough, and palpitation ensue; and at this time, chiefly in consequence of the pulmonary derangement, alarm begins to be entertained, and the approach of phthisis apprehended. Medical aid is now sought, and as the more obvious malady is within the chest, and from the excitement which prevails presents an acute character, blood is drawn, and other means are resorted to suited for arresting inflammatory action. And to a certain extent the practice is necessary and right, for in this state there is often so much inflammation and congestion as fully to justify depletory treatment. Should the disease, however, be misconceived as primary inflammation of the thoracic contents, the relief, however signal at the time, must be transient, and, unless attention be given to those causes from which the perpetual derangements spring, enduring health has but little chance of being restored. Removal of the spinal flexure by using a recumbent instead of a sitting posture; alternating this with regular and proper exercise so as to call into renewed action the weakened and wasted muscles; invigorating these still further by cold sponging and stimulant frictions; and finally, renovating the general health by regulation of bowels, suitable diet, the cold shower-bath, and such tonic medicines as the constitution may need, are the appropriate and only effectual means by which this state of health can be permanently improved.

The views of spinal curvature here presented will be found more fully stated in a paper in the 5th volume of the Midland Medical and Surgical Reporter, to which the reader is referred.

We have already mentioned the injury which constriction of the chest inflicts on the liver and stomach. Either or both of these organs may under this disturbance display the ordinary evidences of local inflammation or congestion, and to these will apply all that has been already stated respecting the heart and lungs. The local inflammation or congestion may be real, and require depletion together with other active remedies, but they are liable to recur if the original disturbing causes be not rectified. They are sensibly aggravated as soon as the spine begins to yield, for according as the body bends forward, the lower ribs in connection with the sternum are forced inwards, increasing the pressure made on the liver and stomach, and further irritating these if already brought into a state of excitement.

But all the evils produced by the vicious course so long and so obstinately persisted in are not yet enumerated, an important train of consequences being yet to be noticed in the derangements of the uterine system. When the age of puberty is approached, the organization distinctive of sex becomes more fully developed, and in the female constitution certain changes take place the suppression or retardation of which is fraught with injury to health. Of these changes one of the most important, and that which is most liable to be effected by contingent influences, is menstruation. This function we mean here to consider only so far as it is prejudiced by the causes of ill health now under consideration. For menstruation to commence at the proper age and to continue regular and perfect, it is requisite that the whole frame be in a healthful state and every function adequately performed; consequently, the general depravation of habit lately described is eminently unfavourable to the establishment of this natural process. There is also required a certain vigour of the constitution capable of propelling blood with sufficient energy into the capillary vessels, which vigour habits enfeebled in the way lately noticed do not possess. It is further necessary that the larger trunks leading to these capillaries be not overcharged, else congestion takes place, which further debilitates the overloaded vessels, rendering them still less capable of propelling their contents into the capillaries by the secerning functions of which they would be relieved. Yet this congestion is prevented by the impeded circulation arising from constriction of chest, and by the disturbance of the abdominal viscera lately explained. It is necessary, also, to take into account the various coincident efforts made by the constitution towards preparing for the signal revolution in the system which incipient menstruation indicates. When these efforts are defeated by menstruation not commencing at the proper period of life, much additional derangement of health ensues, and blood which ought to be disposed of by the uterine vessels becomes either congested in the surrounding tissues, or determined to other parts, so as to cause vicarious hemorrhages of various kinds. Thus the regularity and efficiency of the uterine functions, so essential to female health, become impeded and impaired by the injudicious measures which, when first resorted to in childhood, are little suspected of exerting any such influence.

Although so much has been attributed to constriction of chest in impairing general health, and occasioning special derangements, and assuredly not more than strict truth warrants, many other errors of physical education lend their aid to produce that feebleness of constitution and delicacy of health of which so many females are the victims. These shall be now considered under the same arrangement which was followed with respect to the earlier stages.

Clothing.—The clothing of young females is far from being what reason would sanction. It is oftentimes deficient in the necessary warmth, the materials being too slight to yield protection against the vicissitudes of a variable climate, and too much of the person being wholly exposed. Errors of this kind, however, are much more common and carried to much greater lengths at the period when *education*, in its usual sense, may be said to be completed; that is, when the young lady passes from the restraints of the school-room to the dissipations of fashionable life. As, however, this change usually takes place before the body has attained its full vigour, the following remarks on the dress and conduct of females, on first leaving school, belong properly to our subject. If the errors of dress are less signal in the attire worn by day, they reach their acme when the evening rout or midnight ball is to be attended. At these seasons the tightly-laced stays, exposed chest, and thin draperies, furnish a combination of influences, the continued effects of which no constitution could withstand; while to these is yet to be added that of respiring for hours a heated and vitiated atmosphere, and, after this, of passing, when relaxed and exhausted, into the cold currents of a frosty night air. So far from wondering that many suffer from these egregious imprudences, our surprise should be that any escape; and instead of the inherent delicacy so often imputed to the constitution of females as explanatory of their peculiar ailments, we have ample proof, in their powers of resisting such noxious influences, that they possess conservative energies not inferior to those of the most robust male. Were men to be so laced, so imperfectly exercised, so inadequately clothed, so suffocated, so exposed, their superiority of bodily vigour would soon cease to have any existence.

Defect of clothing, though most signal in the chest and shoulders, is not confined to the upper part of the body. The feet require warmth, which subservience to fashion prevents. They cannot be compressed but at the cost of much suffering, some distortion, and the infliction of positive disease. Fashion also permits the legs to be covered with only the thinnest materials. Thus the capillary circulation of the feet, rendered sufficiently languid by the general weakness, becomes further impeded by the pressure of tight shoes, and the debilitating effects of cold. The crippled state, too, thus occasioned, is a further obstacle to efficient exercise, and so adds to the general debility.

Food.—The food of the young of both sexes, as indeed of every age, should be suited to the particular constitution. The general principles for regulating it have been already laid down. It should, for reasons already assigned, be rather nutritious than spare. The effects of casual repletion are less prejudicial, and more easily corrected than those of inanition; still the bounds of temperance should never be exceeded. There should be a due admixture of animal food, but wine and stimulants are needless and improper. It is to be hoped that no caution is needed at the present day against a practice, not unknown in the last century, of females inclining to corpulency reducing themselves by abuse of acids. The effect was produced by destroying the tone and injuring the structure of the digestive organs, and from the evils which resulted, we would fain hope that a practice so pernicious has been for ever abolished.

At the ages under consideration the state of the bowels requires to be attended to; and here again, girls suffer in a much greater degree than boys. The abdominal congestions to which their whole course of discipline subjects them, have no means of relief save the increase of alvine excretions. There is, therefore, even more to be carried off through this outlet than a state of health would supply. Yet from the general debility and deficient exercise the alvine discharges are very prone to be irregular and inadequate. Much disease would at this age be averted, and the conservative powers of the constitution would have a far better chance of being effectively exercised, if a regular and healthful state of bowels was maintained. For this there should be not only daily evacuation in sufficient quantity, but, what is still more important, the matter discharged should be of a healthy character. And here we would caution medical men against being misled by false delicacy so as to trust to reports, which are never to be relied on. Ocular inspection furnishes an indication of the highest value, both in exhibiting and withholding medicines; and so assured are we of its absolute necessity as a guide to medical judgment, that we cannot understand how a medical practitioner can conscientiously perform his duty who disregards it. As it is the duty of the medical practitioner to avail himself of this source of information when attending patients under disease, it is equally so to point out to convalescents the importance of it to the maintenance of general health. Were the state of bowels in young females more attended to, ample evidence would be furnished of the necessity of some evacuant or corrective discipline, long before the accession of actual disease; and, what is of more importance, much accumulated and too often intractable disease might thus be altogether averted.

Exercise.—What has been already stated with respect to air and temperature in infancy and childhood can be so readily applied to the more advanced ages, that they need not here be further discussed. Exercise, however, demands some additional notice. Boys enjoy this freely, and of the best kind, in the unrestrained indulgence of their youthful sports. By means of these every muscle of the frame comes in for its share of active exercise, and free growth, vigour, and health are the result. It would be happy for girls if some portion of such latitude were allowed to them also. But it is far otherwise. Even under the more favourable circumstances of country life, they are too much restricted from the free exercise which health requires. Their very dress unfits them from taking it, and the alleged indecorum of those active movements to which youth and spirits instinctively incite, is a bar to even the attempt being made. At their age the measured, slow-paced, daily walk is quite insufficient even for the muscles specially engaged, while it leaves many others wholly unexercised. If this be true of the more hale and robust inhabitants of the country, how much more forcibly does it apply to the delicate and attenuated residents of towns, and especially to the inmates of female schools. Of these establishments the systems and habits require much revision, and until some effective reformation takes place, of which there is yet but little prospect, they will not fail to excite our sympathy and regret for the blanched aspects, shadowy forms, and sickly constitutions so continually presented, and which it is so painful to witness. Such beings are as little fitted for encountering the toils or fulfilling the duties of life, as are plants of a hothouse for being transferred to the open borders.*

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* The amount of exercise, or rather the extent to which the *want of exercise* is carried, in many boarding-schools, will appear incredible to those who have not personally investigated the subject. The following is the *carte* of a young ladies' boarding-school, drawn upon the spot, a few years since, from the report of several of its inmates:—

At 6 in the morning the girls are called, and rise.
From 6 to 8, learning or saying lessons, *in school.*
8 to 8½, at breakfast.
8½ to 9, preparing lessons *out of school.* (*some* of the girls permitted to do so in the garden.)
9 to 1, at various tasks, in school.
1 to 1½, out of school, but must not go out of doors; reading or working, and preparing for dinner.
1½ to 2, at dinner.
2 to 5, in school, various tasks.
5 to 5½, tea.
5½ to 6, preparing to go out; dressing, or reading, or *playing in school.*
6 to 7, walking, generally arm-in-arm, on the high-road, many with their books in their hands, and reading.

By the foregoing statements we do not mean to cast the slightest reflection on those by whom these seminaries are superintended. We have ever found them most solicitous for the health of their pupils, sedulous to preserve it, and when disease arose, unremitting in devoted attentions. But the system is faulty, and for this they are not accountable. By the influences and prejudices which uphold that system, they, like others, are chained; and until the system itself yield to increasing knowledge, juster views of the animal economy, a more correct conception of mental energies and of the injuries which their overcitement occasions both to themselves and to the bodily frame, and a firm resolution not to barter health for vain accomplishments;—in other words, until both mental and physical education undergo considerable reformation and be founded on more rational principles, the evils must exist to an extent which no superintendent of a seminary can control. We are sorry to be compelled by truth to add that we have often found the same pernicious regimen carried to as great a height, although on a smaller scale, in private families, under the eye of a fashionáble governess and a fond but injudicious mother.

Hurried breathing, short cough, palpitation, constitute a state of indisposition ere actual disease is considered to exist. Weak back, with incipient curvature of spine, in time aggravate these deviations from health. Irregular bowels attend, impairing still further the general health, and giving rise also to special ravages of the most formidable kind. A hard and tumid abdomen follows, the precursor and eventually the index of mesenteric derangement, which, next to phthisis, is perhaps the most intractable malady of youth with which the physician has to contend. Other evils, referable to the erroneous system and to the debility occasioned by it, may also be seen. Of these, chilblains are very common, and, when they occur, add greatly to suffering and to the further decline of health. They arise from failure of circulation, and, locally considered, are analogous to frost-bitten parts; being in fact so many partial mortifications resulting from loss of vitality in the capillary vessels. The surgical treatment which they receive is not always judicious. Regarded too much as local sores, and the irritability which they display being too much heeded, rest is enjoined, and thus even the insignificant exercise previously taken is suspended. Far better would it be, when this evidence of impaired vigour presents itself, to disregard the local ailment, and look solely to the constitutional state in which the local malady has its origin.

It is a prevalent opinion with teachers and parents that it is more conducive to the progress of education to keep a child at school when in infirm health, where the studies may still be continued, at least in some degree, than to interrupt them entirely by a removal to the parental roof. This is a great and often a fatal mistake. By such delay nothing is lost that can under such circumstances be accomplished: feebleness of body is little favourable to the full exercise of mental energies. Mental faculties depend for their manifestation and exercise on bodily organs, and in proportion as the organs are weakened, does the vigour of the faculties decline. By suffering both organs and faculties therefore to acquire renewed vigour, powers of effective exertion are recoverable to an extent fully capable of compensating for the temporary inactivity. It is a great mistake to conceive that education advances in proportion to the time devoted to it, or to the earnestness with which it is pursued. Mental powers are capable of a certain exertion only, and if they be overstrained, or too assiduously employed, they weary and decline, accomplishing much less than, with unimpaired vigour and more moderate exertion, they would be capable of doing in much less time. Every student is conscious of the inequality of his mental powers under different states of bodily health and different degrees of mental weariness, and fully sensible how little progress he makes when a

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Two days in the week they do not walk in the evening at all, being kept in for *dancing;* but, by way of amends, they go out on two other days. from 12 to 1, and then they miss *writing*. It is to be remarked that they *never go out unless the weather is quite fine at the particular hours allotted for walking*. They go to church, all the year round, twice every Sunday, on which day no other exercise is taken.

From 7 to 8, for the older girls, reading or working in school, (this is optional,) and then prayers; for the younger, play in school, and prayers.
At 8, the younger go to bed.
From 8 to 9, the older, reading or working, as before.
9, to bed.

The twenty-four hours are, therefore, thus disposed of:—

	Hours.
In bed, (the older 9, the younger 10,)	9
In school, at their studies and tasks	9
In school, or in the house, the older at optional studies or work, the younger at play	3½*
At meals	1½
Exercise in the open air	1
	24

The above account was taken from a second or third-rate school, and applies more particularly to the season most favourable for exercise,—*summer*. It is to be remarked that the confinement is generally greater in these than in schools of a higher order. That the practical results of such an astounding regimen are by no means overdrawn in the preceding pages is sufficiently evinced by the following fact, a fact which we will venture to say may be verified by inspection of thousands of boarding schools in this country. We lately visited, in a large town, a boarding-school containing forty girls; and we learnt, on close and accurate inquiry, that there was *not one* of the girls who had been at the school two years (and the majority had been as long) that was not more or less *crooked!* Our patient was in this predicament; and we could perceive (what all may perceive who meet that most melancholy of all processions—a boarding-school of young ladies in their walk) that *all* her companions were pallid, sallow, and listless. We can assert, on the same authority of personal observation, and on an extensive scale, that scarcely a single girl, (more especially of the middle classes,) that has been at a boarding-school for two or three years, returns home with unimpaired health; and, for the truth of the assertion, we may appeal to every candid *father* whose daughters have been placed in this situation. Happily, a portion of the ill health produced at school is in many cases only temporary, and vanishes after the return from it. In the schools in which the vacations are frequent or long, much mischief is often warded off by the periodical returns to the ordinary habits of healthful life; and some happy constitutions, unquestionably, bid defiance to all the systematic efforts made to undermine them. No further proof is needed of the enormous evil produced by the present system of school discipline than the fact, well known to all medical men, that the greater proportion of women in the middle and upper ranks of life do not enjoy even a *moderate* share of health; and persons, not of the medical profession, may have sufficient evidence of the truth, by comparing the relative powers of the young men and young women of any family in taking bodily exercise, more particularly in *walking*. The difference is altogether inexplicable on the ground of sex only.—J. F. EDITOR.

* Younger only two hours and a half.

forced effort is required. The mind, too, requires variety of exercise in order to employ and gratify the various faculties of which it consists, and if it be chained down to a few objects, and especially if these be little congenial to its prevailing tastes and capabilities, the labour turns to little account. Under the systems of education which prevail, years are wasted in pursuits which ought not to occupy a tenth part of the time, if their value were rightly estimated, and the real powers of the mind properly directed. And this leads us to consider, what has hitherto been but too little attended to in conducting education, the direct influence which the exercise of the mental powers has on the bodily health.

In the few following remarks on this subject we shall draw freely from an admirable paper published in the sixth volume of the Phrenological Journal, entitled "On Mental Exercise, as a Means of Health." The principles inculcated are of the highest importance, and though emanating in this instance from phrenological views, they have also so sure a basis in established physiology, that they may be beneficially applied even by those who still close their eyes to the truths of a science in which the writer of this article has no hesitation to avow his firm belief; and which, justly estimated, has more power of contributing to the welfare and happiness of mankind than any other with which we are acquainted.

The importance of muscular exercise as a means of preserving and improving health is generally admitted. It ministers to the health of the body, and, as the brain has its due share of this advantage, mental energies are also promoted by it. "But there is great reason to believe that exercise of mind, regular active employment both of intellect and of moral feeling, of which the various parts of the nervous system are the organic media, contributes so essentially to the well-being of the whole system, that it cannot be neglected without inflicting positive injury; and that, independently of its mental advantages, it is necessary to the enjoyment of full physical health." It is essential to health that the functions of the nervous system be well performed. But the intellectual powers, with the affective and moral feelings, form a part of these functions, and so intimately connected are the physical and mental energies that they mutually influence each other; so that, in proportion as nervous stimulus is unduly expended on the one, it becomes withdrawn from the other. Deficient or irregular exercise of nervous functions gives rise to much suffering, and in no class of beings more signally than in that to which so much of this essay has been devoted, namely, of young females of the upper and middle ranks, more especially those "of a delicate and nervous constitution, who, without any existing disease, without even having undergone any severe indisposition sufficient to debilitate the system, are nevertheless habitual invalids, and can scarcely venture beyond the limits of the drawing-room, or withdraw themselves from the rays of the sun, without some evil, real or imaginary, instantly overtaking them, and forcing them back to their retreat."

Some of the sources of this extreme delicacy, and the means of remedying it, it has been the object of the foregoing pages to explain. "Young men of the same rank suffer infinitely less, because the constantly recurring calls of business and public life operate upon them as stimuli, and, in spite of themselves, exercise the feelings and employ the intellect on objects of some permanent value and importance, and thus keep up a stir of life and excitement of the system which is favourable to the health of all the functions, and to which unhappily many of the opposite sex remain, especially in their youthful years, altogether strangers."

"The three grand sources of vitality, failure or weakness of which may induce infirm health and delicacy of constitution, are the digestive, the sanguiferous, and the nervous apparatuses; and, accordingly, whenever great debility is observed to exist without any marked local disease, its true cause will almost to a certainty be found in weakness or deficiency affecting one or other of the three great systems of organs just named. If digestion, for instance, be radically feeble, then the chyle or nutritive material will fail, and weakness follow. If the lungs and circulating system be weak, the respiration will be imperfect, and the blood being inadequately acted on by air, its composition will be impaired, and, sent in this state through the blood-vessels, it will no longer afford the usual stimulus and support to any of the organs, and hence again constitutional delicacy. And, lastly, if the nervous functions be defective, not only will the mind suffer, but all the functions of the body will participate with it in languor, because all of them will receive a diminished and vitiated supply of nervous stimulus, a due share of which is essential to their healthy action."

The digestive, respiratory, and sanguiferous functions have been already noticed so far as the purposes of this essay require. It remains, then, only to pursue the consideration of nervous functions as involving and affected by the exercise of mind. So dependent is every part of the frame on the brain and nerves, that if the communication between them be cut off or obstructed by dividing or compressing the nerve which conveys nervous influence, the function of the part, however healthy it may be in every other respect, will cease, be diminished, or otherwise disturbed. When any organ, too, is stinted of its due share of nervous stimulus by the too great activity of some other part absorbing more than its own proportion, the function becomes weakened. Thus a diminution in the tone of all the other organs of the body will be experienced during an over-excitement of a few in writing or thinking intently, processes during which the vital actions and nervous energy are so much concentrated in the head, that from pure want of it the extremities become cold, and the action of the heart is lowered so as to weaken and retard the pulse, thus showing that a weak and inactive nervous system must exert an unfavourable influence on the general health.

For guidance in strengthening and developing the nervous system so as to render it fit for the adequate performance of all its functions, we must look to the general principles of physiology and the dictates of experience. "When any living part is called into frequent and regular exercise, especially if the system is not yet arrived at full maturity, it is observed to become gradually more and more susceptible of action; to increase in size within certain limits determined by the constitution; and thereby to gain strength, as indicated by an increased power of enduring fatigue, and a greater capacity of withstanding the influences of the common causes of disease to which previously it would have yielded almost immediately. The physiological explanation of this, as proved by experiments, is, that exercise causes an increased action in the nerves and blood-vessels of the part, by which its vitality is augmented, and a greater supply of blood and nervous stimulus sent to it to sustain and repair the greater waste that is taking place, and also to supply additional substance to fit it for the unusual demands made on it. The results of this process are visibly exemplified in men whose habits or profession lead them to constant muscular exertion; in sportsmen, for instance, in blacksmiths, dancers, porters, &c.; and if it is less manifest in other parts of the body besides the muscles, it is only from other tissues admitting of less expansion, and showing their increased power in a different way. The improvement of the memory is a familiar instance of an increase of mental power produced by exercise; and the beating sense of fulness and quickened circulation in the head induced by intense study or thought, shows that an organic process goes on when the brain is in activity, similar to that which takes place in the muscular system under exercise." On the contrary, when the organ is little used, little expenditure of its power and substance takes place, little blood and little nervous energy are required for its support, and therefore little is sent; nutrition in consequence soon becomes languid, and strength impaired. To all these laws the brain is subject equally as the rest of the body. Frequent and regular exercise gives it susceptibility of action, with power to sustain it, the nervous energy acquiring strength as well as the vascular. Disuse of its functions, or, in other words, inactivity of intellect and of feeling, impairs its structure, and weakens the several powers which it serves to manifest. The brain, therefore, in order to maintain its healthy state, requires to be duly exercised; and as it consists of several parts, each performing its proper function, and as what holds good with respect to the whole collectively, is equally true of each part individually, it follows that for healthful and adequate exercise every function requires its due share of employment, else not only do the portions consigned to inactivity become impaired, but the general health becomes deranged by the irregular distribution of nervous stimulus thus occasioned. But such is the nature of the mental functions, that each must be excited by its proper stimulus, or both it and the portion of brain subservient to it are consigned to inactivity and consequent loss of power. No one would think of exercising the eye by sound, or the ear by colours. The effect of mere quiescence arising from the want of appropriate stimulus is signally manifested in the case of persons, and especially of the young, who in one situation manifest certain faculties very feebly, but who, when removed to another in which appropriate and adequate stimulus is supplied, evince powers such as they were never previously supposed to possess. When we consider how few of all the faculties which the mind possesses are duly exercised in the courses of education, both for males and females, which prescription, prejudice, and fashion have ordained, we can have little difficulty in comprehending how nervous derangements of various kinds result from causes so efficient in producing them. "An appropriate example may be found in the case of a nervous young lady, whose education has communicated nothing but accomplishments, who has no materials of thought, and no regular and imperative occupations to interest her and demand attention: who takes no active part in promoting the welfare and comfort of those about her; who looks to others for support and sustenance; and whose brain is in fact half asleep. Such a person has literally nothing on which to expend half the nervous energy which nature has bestowed on her for better purposes. She has nothing to excite and exercise the brain, nothing to elicit activity; her own feelings and personal relations necessarily constitute the grand objects of her contemplations; these are brooded over until the mental energies become impaired; false ideas of existence and of providence spring up in the mind; the fancy is haunted by false impressions; and every trifle which relates to self is exaggerated into an object of immense importance. The brain, having literally nothing on which to exercise itself, becomes weak, and the mental manifestations are enfeebled in proportion; so that a person of good endowments, thus treated, will often exhibit something of the imbecility of a fool. But suddenly change the circumstances in which such a person is placed; suppose, for example, that her parents lose their health or fortune, and that she is called on to use her utmost energies in their and her own behalf; that in short her brain and mental faculties, her intellect and her moral and social feelings, are blessed with a stimulus to act; the weakness, the tremors, the apprehensions which formerly seemed an inborn part of herself, disappear as if by enchantment; and health, vigour, and happiness take place, solely because now God's law is fulfilled, and the brain with which he has connected the mind is supplied with that healthful stimulus and exercise which he ordained to be indispensable to our comfort and welfare."

We once attended a young lady for various nervous complaints, who possessed the most exquisite sensibility of frame we ever witnessed. For years she had endured almost every form of the most aggravated hysteria. She was brought up with every refinement of education, and the habitual indulgence of every luxury, her parents appearing to live only for the purpose of ministering to her gratifications. Such was her acuteness of sensibility that at certain times the mere opening or closing of a door was agony; such her helplessness, that oftentimes she could scarcely muster energy enough to raise her hand to her head. In the midst of this her father became bankrupt, and soon after died. His family were now obliged to labour for their support, and on this feeble creature devolved much of the care of providing them subsistence. She had talents, and she exerted them. With the assistance of friends she opened a school, which she superintended with unremitting assiduity. Her nervous maladies vanished, and for years she persevered steadily in her altered but more happy course of life. It would have been fortunate if she had commenced this earlier; for the delicacy of constitution created by early mismanagement laid the foundation of phthisis, of which she eventually became a victim.

While inactivity of brain leads to evil, over-excitement is no less injurious; and if persisted in without suitable relaxation, exhaustion and permanent weakness are the results. In ordinary education both errors are committed. The mental powers exercised are too few, and these are continually overworked, while the larger portion is left to chance for obtaining any exercise at all. In education, too, attention is too exclusively directed to the intellectual powers, while the effective and moral faculties are unheeded, or only acted on through the intellect. And yet they admit of rational culture equally as the intellectual powers, while on them and on their government do the virtue and happiness of mankind far more depend. Intellect is no doubt capable of assisting in this government, but never can the moral feelings be disciplined through intellect alone. Ethical discourses, the most eloquent and conclusive, may be pronounced, but alone they reach not the heart. The moral sentiments, to be truly cultivated, must be felt; objects must be presented capable of exciting emotions; and then intellect may interpose to assign the just limits of their indulgence. No discourse on charity can have the effect of a real opportunity for doing a benevolent action. No lecture on justice can make impression equally as an occasion of exercising this quality, especially where other incitements opposed to it require to be overcome. A conquest thus gained does more to confirm the principles, from the deeper impression made by a practical example beyond that of a speculative rule, and from conscious satisfaction and heartfelt pleasure derived from every victory over self, when once the victory is completed, than all that the most profound moralists ever wrote. The minds of the young should be exercised in all the faculties by which their social condition in after-life is to be maintained, and in this some attention should be given to the natural order of their development; for some precede others in activity, and also become more quickly matured. Most of the affections and moral sentiments may be observed in their manifestations even in the cradle. Of the intellectual powers, those which are employed in acquiring a knowledge of the external world are earliest developed. The reflective faculties advance more slowly, and hardly attain full power until the body reaches its full growth. Much of our ordinary courses of education is in opposition to these facts. Many of our classical books which mere boys are condemned to read, require not only mature intellect, but considerable knowledge of the world for their comprehension.

The object of education is to fit human beings for maintaining their social relations, and performing all their several duties in life. For this end they should learn the properties of bodies, and also the qualities by which men act on these and on each other. Minute and intimate knowledge of all these it would be impracticable for any individual to attain, nor is it necessary; but an outline of them is within the reach of all, and this, which to any ordinary capacity would be only pleasurable acquirement, may prove of much practical utility, while by exercising the cerebral organs it will invigorate both these and their functions, be a source of much pure gratification, withdrawing the mind from selfish and sensual pursuits, and through its manifold influences have a beneficial effect on the general health. The various branches of natural science are among the best exercises on which the young mind can be employed; for while they engage a large number both of the knowing and reflecting faculties, they incite also several of the higher sentiments by presenting to the mind the wisdom and goodness of the great Creator, so abundantly displayed in all his works; the benevolent purposes for which all these are designed, the good which they impart, and the happiness which they diffuse. Such contemplations withdraw the mind from selfish passions, consigning them to that quiescence which lightens the task of keeping them under due control.

Above all other studies, however, that of the mind itself is the most interesting and the most important. By it alone can we form a just estimate either of ourselves or others, or have any clear conception of the powers with which nature has endowed us. Some knowledge of these powers must be of material assistance to us in regulating their exercise, ascertaining their objects, and restraining their excesses. The subject, however, is far too copious for this place, and unsuited for the present occasion. What has been adduced was necessary in order to convey any conception of the influence of mental actions on the bodily frame, and to show the intimate connection that subsists between mental and physical education. That the foregoing sketch of the latter is far from complete we are well aware. Many points of detail have been passed over or slightly noticed, which would admit of more copious illustration and more explicit instruction. If we mistake not, however, enough has been advanced to display the principles on which physical education should be conducted; and an outline at least has been furnished which each reader may readily fill up according to his intelligence, and to the condition of life to which it is to be applied.

E. Barlow.

ELECTRICITY.—When a substance has acquired the power of first attracting and then repelling light bodies placed in its vicinity, and of emitting sparks, it is, in the language of electricians, said to be *excited*. These phenomena, we are told, were first observed by Thales of Miletus in a piece of amber, which by the Greeks was called ἤλεκτρον, and hence the origin of the term electricity.

Electricity may be developed by several means, the chief of which are friction, the contact of dissimilar substances, pressure, variations of temperature, and chemical action. In the present article we shall confine ourselves to the first-mentioned source, and shall dwell even upon it no further than may be necessary for rendering intelligible what we shall have to say respecting the therapeutic applications of the electric fluid.

When a glass rod is rubbed with silk, and then brought close to a little sphere of elder pith suspended by a silk thread, a combination commonly called an electric pendulum, the sphere is first attracted by the glass, and, upon contact, immediately repelled. But upon substituting for the glass rod one of metal, no such phenomena will be observed. Such experiments have suggested a division of bodies into two classes, the electrics and the non-electrics, or those which admit and those which do not admit of being rendered electric by friction. Glass, sulphur, wool, silk, and all resinous substances are electrics. Carbon, the several metals, water, and every variety of organized substance, in consequence of the water which all such include, acid and saline solutions, &c. are non-electrics. This division, however, we shall presently find to be based upon an erroneous supposition. All bodies, in fact, are electrics; and if there are some which, under ordinary circumstances, do not appear to become excited by friction, it is because the electricity is permitted to flow from them into the earth as fast as it is generated.

This brings us to another division of bodies, having reference to their electrical relations, founded on a different principle, namely, that which resolves them into conductors and non-conductors, or rather into those which are with facility and those which are with difficulty traversed by the electric fluid; for, strictly speaking, there is no absolute non-conductor. If a glass rod be applied to an excited body, it will become electrified merely at the point of contact. But if a metallic rod, suspended upon silk, be applied in a similar manner, it will at the same instant exhibit symptoms of excitement at every point. This simple experiment illustrates sufficiently the difference of the conducting powers of the two rods.

When a body is surrounded on every side by non-conductors, it is said to be insulated. Thus a ball of metal resting upon a cake of resin, or a stool with glass legs, or suspended by a silk thread, is insulated, for it is in connection with the earth only through the medium of non-conductors. If the insulation were perfect, the ball once electrified should continue so for an indefinite time. In practice, however, this never occurs, for the reason already assigned, namely, that there are no absolute non-conductors. Dry air is probably the best insulator with which we are acquainted; but, by impregnation with aqueous vapours, it acquires conducting powers.

The two divisions just noticed admit of being reduced into one, the electrics being non-conductors, and the non-electrics conductors. It is, in fact, owing to this latter coincidence that some bodies appear incapable of being excited. Thus, if a disc of copper, held in the hand, be rubbed with a silk handkerchief, it does not become excited; but if, before the application of the friction, it be insulated, the usual phenomena manifested by electrics will present themselves.

In every case of electrical excitement two distinct powers are cotemporaneously developed. Thus, when glass is rubbed by silk, both become electrified, as may be proven by approaching them in succession to an electric pendulum. The electricity of the glass, however, is different from that of the silk, for when either is communicated to two contiguous pendulums, these repel each other. But when the electricity of the glass is communicated to one pendulum, and that of the silk to the other, attraction ensues. These different powers require to be designated by different names, and hence the terms *vitreous* and *resinous*, which, whatever be the substances rubbed, are applied to the distinct energies developed by the process of friction. Such was the language of Dufay. But, in more modern times, these designations have been by some replaced, particularly in Great Britain, by the terms *positive* and *negative*, introduced by Franklin, the former corresponding to the vitreous, the latter to the resinous electricity of Dufay. This difference of nomenclature depends upon the different opinions entertained by these philosophers respecting the nature of the electric influence. Dufay viewed it as a compound, Franklin as a simple fluid. The former referred all electrical phenomena to the resolution of the compound into its vitreous and resinous elements. The latter explained them by supposing that all bodies, in their natural or neutral state, contain a certain quantity of the electric fluid, and that the processes, which produce electrical excitement, operate merely by disturbing this proportion, and thus causing an accumulation in some and a deficiency in others. We shall not enter here into any criticism upon the respective merits of these rival hypotheses. Suffice it to say, that the theory of Dufay is that adopted by the highest authorities in science, principally, as it would seem, because of its analogy to that which is alone applicable to the kindred subject of magnetism.

In order to a consistent explanation of all known electrical facts, it is only necessary to suppose, with Dufay, that electricities of the same name repel, and of contrary names attract each other, and with a force varying in the inverse ratio of the square of the distance. This principle of the action of the elementary fluids at a distance is applicable to a multitude of phenomena, amongst others, for example, to the charging of the Leyden phial. By electricians it is known under the name of *induction* or *influence*. It may be illustrated by the attraction already noticed as occurring when we approach an excited glass tube to an electric pendulum. The vitreous electricity of the tube decomposes the natural fluid of the ball of the pendulum, attracting its resinous and repelling its vitreous element; the attraction, however, being more energetic than the repulsion, inasmuch as it is exerted at a shorter distance. But, as the ball is insulated, its constituent electricities are merely separated from each other, but cannot leave it; hence it will itself be carried towards the tube, and with a momentum corresponding to the difference of the opposed forces.

There is but one point more connected with the theory of electricity to which it is necessary to advert here. When a body is electrically charged, the free electric fluid is confined solely to its surface, and does not, as experiment proves, dip to any appreciable depth into its substance. Its distribution, however, on the surface is never equable, except in one case, namely, when the body is a sphere. In all other solids it accumulates in greatest quantity upon the most prominent or projecting points. But the tendency of the electric coating of an excited body to escape, is, as Laplace has shown, proportional to the square of its thickness. Hence we deduce the practical inference that a body studded with points cannot be strongly charged, for before much free fluid has been communicated to it, such a quantity will have accumulated at the points as to flow out in a continued stream, by forcing a passage through the atmosphere.

Having disposed, in this short summary, of the principles of electricity, we shall now briefly describe such articles of electrical apparatus as are indispensable with a view to its application as a medicinal agent. These are the machine, the insulating stool, the director, the Leyden jar, and the discharging electrometer.

The electrical machine is the piece of apparatus employed for the purpose of obtaining electricity in considerable quantity. It consists essentially of three parts; the rubber, the substance rubbed, and the conductor or conductors, for there are sometimes two of them. The substance rubbed is invariably of glass, and is sometimes a flat disc, but more usually a cylinder. By a winch handle, attached to one extremity of its axis, a motion of rotation is given it, and it is thus made to slide upon the rubber, which is nothing but a leathern cushion, to which a small quantity of an amalgam (composed of one part of tin, two parts of zinc, and six parts of mercury) is usually applied, and to which is appended a flap of silk, which embraces the semi-circumference of the cylinder, or, in the case of the *plate*, in which there are two cushions, extends from an extremity of the vertical to one of the ends of the horizontal diameter. The friction exerted between the glass and the rubber effects a continued decomposition of the electric fluid residing on their common surface, the vitreous or positive element being determined to the glass, and the resinous or negative element to the cushion. The latter passes at once to the negative conductor which is in contact with the rubber,* and from it, if uninsulated, into the earth. The former developes, by the process of induction, electricity of the same name in the positive conductor, which is an insulated metallic cylinder, or system of cylinders, straight or curved, presenting to the glass a number of points, which are placed at a distance from it not exceeding a quarter of an inch. When positive electricity is required, the negative conductor must be uninsulated, by hanging upon it a metallic chain so that it may reach the ground. On the other hand, when negative electricity is required, the negative conductor is insulated, and the positive one put in connection with the earth. In order that the machine may work well, it is necessary that it be rendered perfectly clean and dry, by placing it before the fire, and rubbing it carefully with silk or flannel. Especial care must be taken that the conductor of which the electricity is wanted be well insulated, and this is best ensured by gently heating its glass leg; for the deposition of hygrometric moisture upon it is thus rendered impossible.

The nature of the insulating stool is announced by its name. The back may be of any material, but the legs are invariably of glass, this being the strongest of all non-conducting substances.

The director is a brass rod of about a foot in length, terminating at one end in a ball of the same metal, and at the other in a glass handle. The ball admits of being screwed off, and, when removed, exposes to view the extremity of the director ending in a fine needle-point. This point should also screw off, for the purpose of being occasionally replaced by one composed of baked wood, or of brass covered with lac varnish.

The Leyden jar is a cylindric glass vessel, coated within and without to about two-thirds of its height with tin-foil, and closed above by a wooden plug perforated by a brass wire, which terminates outside in a ball or knob, and inside in a chain prolonged so as to reach the inner coating. To charge the jar, its knob is made to touch one of the conductors of the machine while in action, its outer coating being, at the same time, uninsulated by being held in the hand, or in any other way put in connection with the earth through conducting substances. The inner coating obviously acquires the electricity of the conductor which it touches, while the outer surface becomes, at the same time, charged with the opposite fluid in virtue of the principle of *influence*. To *discharge* the jar, the two surfaces are to be connected by some good conductor. Thus, upon applying one end of a metallic wire to the outer coating, and approaching the other to the ball or knob, the opposite electricities rush together, presenting the phenomena of the spark, — that is, a flash of light accompanied by a sharp snapping sound, and both surfaces return to the natural state.

Of the discharging electrometer there are many modifications. It is, however, essentially nothing but a brass rod terminated by balls, and supported in the horizontal position by a glass leg. If, while a jar is charging, one end of the rod is placed within one-eighth of an inch of its knob, the other extremity being connected, through some conductor, with the outer coating, a very slight charge will cause the spark to pass between them. If the distance be now increased to a quarter of an inch, a stronger charge must be communicated to the phial before its spontaneous discharge will take place, and so on, so that, by properly adjusting the distance, we can regulate the maximum charge at pleasure.

When a spark is taken by approaching the knuckle to a machine in action, it causes a peculiar pungent sensation, the nature of which it is not easy to convey by description. Generally speaking, however, when thus produced, it is not, unless the machine be very powerful, accompanied by much pain. But if a loaded jar be discharged through the body, which may be readily done by applying one hand to the external coating and the other to the knob, a sensation of an exceedingly distressing kind will be experienced, which is usually and very appropriately denominated the *shock*. The distance to which the shock extends depends upon the magnitude of the coated surface and upon the intensity of its electricity. Thus, with a certain charge, it is felt at the wrists, with a stronger at the elbows, and with a still stronger, even at the chest. A surface of thirty square inches, when loaded by a common machine, is capable of destroying mice and small birds, and there are few individuals of the human species who can receive with impunity the maximum charge of a square foot, or one hundred and forty-four square inches. It is worthy of remark that the bodies of animals destroyed by the electric shock are very prone to putrefaction, that the irritability of the muscular system seems almost entirely destroyed, and that their blood does not coagulate. Similar observations have been made upon animals struck by lightning.

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* In the plate-machine there is no negative conductor, the cushions being, through the wooden frame, in connection with the earth.

The influence of the shock seems particularly directed to the nervous system. A small charge passed through the head of a bird deprives it of sight, and a considerable one received in the head by Mr. Singer had the effect of a violent blow, and was followed by a temporary loss of memory. When a jar is discharged along the spine of a person in the erect position, the action of the muscles is for a moment suspended, and he falls to the ground. Electricity, therefore, produces a paralysing effect when brought to bear upon the centre of the nervous system. But when transmitted to the muscles of a limb, the invariable consequence is their spasmodic contraction, and this is true even though the member be in a paralytic state. Some recent researches, which will be noticed under the head of GALVANISM, render it highly probable that the muscles are not directly sensible to the stimulus of electricity, but that they are thrown into convulsive action by the electric fluid, merely because of its traversing the nerves by which they are supplied.

Electricity was very early employed as a therapeutic agent, and is even still resorted to by physicians, though it has lost much of the celebrity which it once enjoyed. The diseases in which it is applied are the different forms of paralysis, including amaurosis and deafness when functional affections, epilepsy, hysteria, chorea, chronic rheumatism, particularly those forms of it which produce stiffness of the joints, cases of retention or suppression of the menstrual flux, nervous headachs, and local pains unconnected with inflammation, asphyxia produced by drowning or the irrespirable gases, enlargements and obstructions of the glandular system. These are the affections for which it is still prescribed, and occasionally with success. But there is scarcely a disease in nosology for which it has not at one time or another been recommended.

As a remedial agent, electricity may be applied in five different ways. The first method, which is, we believe, at present employed, is to *excite* the patient by placing him upon an insulating stool, and putting him in connection with the prime conductor of a machine in action. This is what is called the electric *bath*. It was strongly recommended by Priestley, apparently under the impression adopted from the Abbé Nollet, that the animal functions are, under such circumstances, discharged with increased vigour, particularly the circulation of the blood and the cutaneous secretion. Such effects are sometimes observed, but by no means invariably. The bath was employed by Lit and De Haen, two early writers upon medical electricity, for the treatment of hysteria.

The next and simplest method of applying electricity to the cure of disease is to present the member, or part affected, to the prime conductor of the machine, and thus cause it to receive a succession of sparks; or, what is more convenient, to place the patient on a chair, and convey to him the sparks by means of a director connected with the conductor by a chain. The patient may manage the director while the operator works the machine.

The third mode consists in placing the patient upon an insulating stool, putting him in connexion, through means of a chain or metallic rod, with the prime conductor, and drawing sparks from the seat of disease or pain by simply presenting to such part the knuckle, or, should the operator dislike receiving the spark himself, an uninsulated director. This method of operating has the advantage over the preceding that it conjoins the electrical bath with the influence of the spark. It is, therefore, that usually adopted by those experienced in the medicinal administration of electricity. The force of the spark is proportionate to its length, so that, by properly diminishing this, its strength may be reduced to any required standard.

A favourite mode with some practitioners of applying sparks is to *give* or *draw* them across flannel. For this purpose, a director, terminated by a large ball, which is to be covered with a fold of flannel, is approached in the usual way to the organ to be electrified. Instead of a single strong spark, a series of weak ones will thus be produced, which, emanating at the same instant from several of the woollen fibres, extend over a considerable surface and produce in it a peculiar pricking sensation. The ball of the director may be naked, the flannel being laid on the part of the body which is to be submitted to the influence of the sparks. This method is supposed to be particularly suited to the treatment of rheumatism and paralysis, especially in patients who cannot endure the stronger forms of electricity.

The next form of medical electricity to be noticed is the *aura*, or jet of air, which proceeds from an electrified point. This is the modification of the electric influence to which ulcers, excoriated surfaces, and delicate organs, such as the eye and testicle, are usually subjected. The common method of employing the aura is to present a pointed director, connected by a chain with the conductor of the machine, and held by a glass handle, to the part affected. The particles of air in contact with the point are highly electrified, and, of course, immediately repelled. The same occurs to those which take their place, and so on in succession, producing a current of highly excited air, which, as has been just described, is directed upon the organ which is the subject of electrical treatment. The aura may also be applied by placing the patient upon an insulating stool, and directing an uninsulated pointed director to the seat of disease. It is, however, seldom resorted to, as its efficacy is more than questionable.

When the point which terminates the director is of baked wood, this being a bad conductor, the electricity does not issue in a continuous stream, but as a succession of minute sparks, which produce in the part of the body upon which they are directed a sensation perfectly similar to that which attends electrization across flannel. This kind of electricity is applicable to cases where the aura is not sufficiently energetic, and where the sparks proceeding from a ball are found too pungent.

For the application of electricity to deep-seated parts, such as the exterior of the mouth or the bottom of the external meatus of the ear, a particular form of director has been devised, the description of which may with propriety be given here. A glass tube of about one-tenth of an inch internal diameter is left open at one end, and is closed at the other by a cork, through which there slides a brass wire, terminated within by a ball, which, as in the common director, screws over a point. To apply this instrument, the open end of the tube is introduced, we shall suppose, into the ear, and the external extremity of the wire being brought as close to it as may be deemed advisable, sparks, or the aura, are communicated or drawn in the usual way. The glass tube, being a non-conductor, prevents any lateral divergence of the electric fluid, and directs it upon the point placed immediately beneath its orifice.

When *shocks* are deemed necessary, we must have recourse to the Leyden jar, and this constitutes the fifth form under which electricity may be exhibited medicinally. The method, of course, consists in discharging a loaded jar through the affected part or member as often as may be considered advisable. The readiest method of accomplishing this is to place the free extremity of a copper wire, wound about the outer coating of a charged phial, in contact with one end of the course which it is intended to make the electricity traverse, and then bring the knob of the jar to the other end. When the knob comes within the striking distance of the body, the discharge takes place, and the shock is felt in the interval which separates the knob and wire. Against this method, however, the objection lies that we are not enabled to measure the amount of the charge, and that the shock, therefore, does not admit of being graduated according to the feelings of the patient, or the nature of the disease. To attain this object, it is necessary to interpose the discharging electrometer, already described, in the arc which connects the outer and the inner coatings of the phial. The knob of the jar being now placed in contact with the conductor of a machine in rotation, and at the selected distance from one of the balls of the electrometer, the discharge takes place as soon as the free electricities have acquired sufficient tension to force their passage through this interval, and a shock is felt in the part of the body which completes the circuit. If this be too strong, the ball of the electrometer must be placed at a less distance from the knob; if too weak, the distance between them must be augmented. The two parts of the body between which it is intended that the electricity shall pass are to be touched by the balls of two separate directors, held by an assistant, and connected, by means of chains, the one with the electrometer and the other with the outer surface of the jar. Thus, if one of the directors be in contact with the hip, and the other with the knee, when the discharge takes place, the shock will be felt along the entire thigh.

This method of regulating the shock should be familiar to such as employ electricity in the practice of medicine. The discharge of a small jar proves fatal, as we have seen, to the smaller animals; and there can be no doubt but that by means of a battery of no very great surface human life might be destroyed. The power, too, of sustaining the shock is very different in different individuals, and even varies in the same person so as to differ at different times, and in different states of the system. These circumstances enjoin caution in the administration of electricity, particularly by means of the jar; and it may be added that, in point of fact, its injudicious and indiscriminate use has proved extremely injurious. To this effect may be quoted the case of a young girl labouring under paralysis of the right arm, related by Dr. Harte, (Phil. Trans. vol. iii.) who, after two shocks, became universally paralytic. From this state she was with difficulty recovered by judicious medical treatment, but relapsed upon being again subjected to three discharges of the Leyden jar. After the lapse of four months she was again relieved of the maladies inflicted upon her by electricity, and, nothing discouraged by his first failures, the doctor, it is said, would have resorted to the shock a third time, but Priestly quaintly observes, "the girl being more nearly concerned in the experiment than her physician, thought proper to decline it." The medical reader who resides in the vicinity of an electrizing quack will, no doubt, be able to call to mind similar cases.

In the employment of electricity as a curative agent, there are certain precepts to be borne in mind, without an attention to which disappointment will be often experienced, and unmerited discredit thrown upon a really efficacious means of subjugating morbid action. These may be reduced to the following heads.

1. Electricity should be only considered as auxiliary to other modes of medical treatment which experience has shown to be advantageous. Thus, in rheumatism, it may be combined with diaphoretics; in chorea, with tonics; and in paralysis, with medicines which, like strychnia, stimulate the nervous system, a practice recently adopted for the cure of palsy arising from the absorption of lead.

2. We should always commence with its weaker forms, such as the bath of aura, next proceed to sparks, and finally, should these prove insufficient, to shocks, taking care to regulate their strength by the means already described, and avoiding their exhibition, when of such degrees of energy as to prove distressing to the feelings of the patient. The sparks applied in amaurosis, or for the discussion of glandular tumours, must be feeble, and in such cases shocks are quite inadmissible. To communicate the latter, a jar, four inches in diameter and six in height, will be found amply sufficient, and its knob need never be placed at a greater distance from the ball of the electro-

meter than one-fourth of an inch. An interval of from one to two-tenths of an inch will, generally speaking, be sufficient.

3. The electrization should be performed daily, and be persevered in for at least a month, if necessary, and a cure must not be despaired of because there is no immediate relief experienced; for the good effects of electricity generally require a long time for being developed.

4. The *aura* may be applied for from five to ten minutes. The number of shocks passed in one direction should not exceed twelve, nor the number of sparks applied to the same part twenty-four.

5. In local affections, the electric fluid should be confined to the diseased part or organ. But in diseases, such as chorea and epilepsy, in which the entire system seems to be engaged, it must be applied generally over the body. Such parts, however, as are affected with pain, or any unusual sensation, should be particularly dwelt upon.

The modus operandi of electricity, in the cure of disease, is considered obscure. It would appear, however, in its ordinary forms to act as a simple stimulant. Upon the nervous system, indeed, it is by many supposed to exercise a particular influence, of the nature of which we shall be enabled to form some idea, should the hypothesis broached in modern times, and which refers the functions of the nerves to currents of electricity transmitted through them from the brain and spinal chord, turn out to be correct. We shall revert to this subject in the article GALVANISM, and shall here merely remark that, assuming the theory alluded to to be sound, it will be proper, in the medicinal administration of electricity, to cause the positive fluid to pass through the body always in the direction of the ramification of the nerves. This precept is particularly insisted upon by some foreign electricians.

The spark received from substances resinously electrified differs, in some respects, from that which issues from surfaces vitreously charged. It is more pungent, and has a different shape, being shorter, and not so regular in form. As medicinal agents, however, they appear both to produce similar effects. A contrary opinion has indeed been maintained by some, who have represented resinous electricity as a sedative, and vitreous as a stimulant. This theory, which is quite unsupported by facts, is not a modern invention. It originated in 1779, with Bertholon of Montpellier, who resolved diseases into two classes, those which depended on an excess, and those which were the consequence of a deficiency of the electric fluid, and treated the former with resinous, the latter with vitreous electricity. It is not necessary to enter upon any formal refutation of such an absurd hypothesis. In it, however, may be recognised the germ of the more celebrated but equally unfounded nosological notions put forward two years after by Dr. John Brown, in his "Elementa Medicinæ."

It has been long suspected, and indeed rendered almost certain by a variety of facts, that the electrical state of the atmosphere has an appreciable influence upon the animal economy. The lower animals seem aware of an approaching thunderstorm, as would appear from the uneasiness which they manifest, the cries which they utter, and their running about in a state of alarm in search of shelter. Many individuals also of the human species, particularly those labouring under certain chronic complaints, or who possess what may be called a great degree of mobility of the nervous system, experience at such times very peculiar sensations. Observations such as these, and many others of a similar description which might be quoted, demonstrate very completely that the animal machine is frequently sensibly affected by the electricity of the atmosphere; and there is even nothing improbable in the conjecture which has been often hazarded, that the salubrity or insalubrity of particular districts and seasons, the existence and the character of epidemic diseases, are in some way connected with, if not immediately dependent upon, the same influence. Upon none of the many branches, however, of this interesting subject can we be said to possess positive knowledge. Experiments must be multiplied before we can acquire data to reason with any precision upon it. Indeed it is only within a few years that these could have been instituted with any prospect of success. Our means of research are at present sufficiently delicate to enable us to commence such an inquiry with advantage; and it is much to be wished that meteorologists may henceforward register the variations in the electrical state of the atmosphere with as much diligence as those which occur to its temperature and pressure.

JAMES APJOHN.

[ELECTRO-PUNCTURE.—See GALVANISM.]

ELEPHANTIASIS. There are two different diseases which possess this common name; they are usually distinguished by the epithets *Arabian*, or of the Arabians, and *Grecian*, or of the Greeks. We shall treat of them under these terms.

ELEPHANTIASIS ARABUM, (*Elephant Leg.*) The earliest account we have of this disease is by Rhazes, an Arabian physician, who lived in 850. In the Arabian language this affection is denominated *dal fil*, which imports literally *morbus elephas*, elephant disease. The Arabians sometimes contract *dal fil* into *fil** alone, literally, *elephas, elephant affection.* This appellation was applied to the disease by the Arabians, in consequence of the huge misshapen appearance of the affected limb being supposed to bear some resemblance to the form of the leg of an elephant.

Elephant leg is known in the West Indies by the name of *Barbadoes leg;* sometimes it is there denominated *yam* leg, from the supposed resemblance the affected extremity has to the fantastic forms which this root occasionally assumes. In Ceylon it is called *Galle* leg, and on the peninsula of India it is denominated *Cochin* leg, from its being indigenous to these places. In the Malabar language it is called *anay kaal*, a term which, like dal fil, imports elephant leg.

Geographical Distribution.—This disease is in a remarkable degree endemic in the island of Barbadoes, on the south-west coast of Ceylon, in the neighbourhood of Cochin, on the Malabar coast, in some parts of Japan, in Egypt, and in Abyssinia. It occurs not unfrequently in almost all of the West India islands and British settlements of South America; in the Polynesian isles; and in the provinces of Castile and the Asturias in Spain. Sporadic cases occur over Europe generally, and perhaps in all parts of the world.

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* Fil alfil, *Arabic;* ulfeel, *Sanscrit;* fil, ulfwall, elephant, *Greek;* elephas, *Latin.* (*Thomson.*)

Persons liable to this Disease. — In Barbadoes elephant leg was, until about the year 1704, confined to the black population. A white inhabitant was attacked in that year; and before the year 1760, when he died, the disease was common among the white population. In general, it would appear that imported Europeans are not liable to the disease unless they reside for a considerable time in the island. It is perhaps owing to this circumstance that soldiers are very rarely affected with it.*

In Ceylon the disease is confined to the indigenous inhabitants, including the half-caste and Creoles. Imported inhabitants, comprehending Europeans, Africans, Malays, or natives of the peninsula of India, may be said to be exempted from its influence. There is only one instance known of a native of Europe having become affected; and in his case the disease did not appear before he had been a resident at Point de Galle between thirty and forty years.

Soldiers and other imported Europeans are not liable to it at Cochin.

The disease affects all ages, although in general it appears in the early period of life; and, in some rare cases, in the first year. Both sexes seem to be equally liable to it, and no condition of life confers an immunity from its influence. Individuals who enjoy every comfort, and who are not exposed to great vicissitudes of temperature or changes of weather, are as liable to elephant leg as those who endure the hardships and privations of life.

Symptoms. — The constitutional excitement, or primary stage of this disease, generally comes on suddenly, with rigors, headach, nausea, pain in the back and loins; to these follow great heat of skin, alternating with profuse perspiration, and ardent thirst. Some particular part of the body (for, notwithstanding the name, the disease is not exclusively confined to the leg,) becomes red, hot, swelled, and painful, especially along the tract of the lymphatic vessels, so as to resemble, in some measure, an erysipelatous affection. The febrile excitement becomes lessened in two or three days, and soon entirely disappears. This circumstance is followed by a cessation of the local inflammatory symptoms, the heat, redness, and pain; and the swelling becomes also greatly reduced, although the part affected rarely returns to its natural size. Paroxysms of this kind succeed each other at intervals of various length, and frequently with some degree of regularity; sometimes they occur as often as once a month, and at other times not oftener than once in six months. Every successive attack adds to the effusion and consequent morbid enlargement of the part affected.

Every part of the body seems to be liable to this affection. It has been observed in the head, the tongue, the neck, the breasts, the abdomen, the thigh, and the skin in general. The condensation of the cellular tissue of new-born or very young children is a form of elephantiasis. The parts most frequently affected are the superior and inferior extremities, the vulva, and the scrotum.

The internal organs are also liable to become affected. Is it not probable that some varieties of enlargement of the liver, and the sarcomatous morbid structure of the ovaria and uterus, are kindred affections, if not the same?

Dr. Musgrave thinks this disease should be termed the *migratory inflammation of the lymphatic system.* He says, "whatever may be its original seat, the patient is never secure, while the constitutional disturbance subsists, from a sudden retrocession to some vital organ. I have seen it in the same case translated from the scrotum to the head, from thence, after some hours, descend with the rapidity of lightning to the abdomen; again migrate to the chest, to return perhaps to the encephalon and prove fatal there; or, under more favourable circumstances, resume its comparatively harmless situation, and run its subsequent course, as if nothing untoward had occurred; and, while occupying the different cavities, giving rise to the ordinary symptoms of acute inflammation of that particular viscus which it had selected for its temporary abode." (Edinburgh Med. and Surg. Journal, No. 92.)

It is not common for more than one part of the body to become morbidly enlarged in the same individual, although this circumstance sometimes occurs. A schoolmaster at Point de Galle had both arms and both legs affected. The scrotum is sometimes greatly increased in size: there was a mendicant at Galle, in whom it descended to the ankle, and who, when he sate to solicit alms, used to sit upon this part of the body, as he would have done upon the trunk of a tree! The leg is, we believe, the part of the body which is most frequently affected, and sometimes it becomes enormously enlarged. Occasionally the swelling is uniform; but commonly the skin is rough, rugged, and scaly, and the enlargement divided into unequal protuberances, which are intersected with deep fissures. The writer of this article was requested to visit a woman at Galle, who, although only about twenty-five years of age, had both of her inferior extremities so much enlarged and deformed, that the back part of the legs rested upon the ground and projected behind the heel, about nine or ten inches. The fissures and interspaces between the projecting and pendulous protuberances had ulcerated, and were discharging a most offensive sanies. Life could not be long preserved under such extensive disease.

Organic Changes.—This disease is evidently, in the first instance, constitutional; and the local affection seems to be a result of some form of the process of inflammation, which recurs at intervals. A quantity of sero-albuminous fluid is effused from the exhalents into the cellular tissue of the affected part, which is not removed by adequate absorption; and the part of the body that may be affected becomes tumid, hard, and misshapen.

Upon examination after death, the subcutaneous tissue of an affected limb is found hard, dense, and interspersed with small cells filled with serous fluid: the aponeurosis which covers the muscles is thickened, as also the cellular and intermuscular tissue. The muscles are less red than natural. The arteries and veins are commonly not materially altered.

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* Dr. Hendy states that horses are liable to the disease in Barbadoes, and that it had been reported to him that dogs, horned cattle, and poultry, were sometimes affected with it.

It deserves to be remarked, that the effused fluid in this disease is always coagulated; it consequently differs much from the serous effusions found in anasarca or ascites. It is still unascertained why it is so seldom absorbed, and so rarely excites inflammation and consequent ulceration. This effusion appears to be extra-vascular, although the fluid does not seem to have the effect of an extraneous body.

Remote Causes.—We know nothing satisfactory respecting the remote causes of elephant leg. It is admitted to be comparatively a new disease in Barbadoes, in as far as imported, if not Creole whites are concerned; and no very important change has been observed in the climate of the island.

The aboriginal inhabitants of Demarara are not liable to this affection, although it is not rare among imported and Creole Africans and the half-caste. It occurs occasionally among the Creole whites; and perhaps there are about two cases of elephant leg in the colony among the imported Europeans. The progeny of Dutch families are more liable to morbid enlargements of the body than British Creoles. In this colony the disease is chiefly observed on the sea-coast.

In Ceylon it scarcely ever occurs except among the indigenous inhabitants of about eighty miles, or one-ninth, of the sea-coast of the island. At Point de Galle, which is the principal village embraced by the above range, the disease is extremely frequent; so much so that perhaps one-third, if not one-half, of the susceptible inhabitants are more or less afflicted with morbid enlargement of some part of the body. In other respects this is as healthy a portion of the island as any other: it is remarkably free from remittent or intermittent fever. Elephant leg seems to be endemic in the south-west coast only; and persons who are regularly affected with periodic attacks in that part of the island escape a recurrence of the paroxysms when they change their place of residence to the interior, or to another part of the coast. Cochin is considered a very healthy station for troops.

Exciting Causes.—The exciting causes are equally obscure. Drs. Hillary and Hendy attribute it to sudden changes of temperature; but we think without good foundation. We have known the disease affect nearly every member of a large wealthy family in Galle, the females of which, as they did not expose themselves to the sun, were not liable to a transition of temperature above ten or twelve degrees during a whole year. Dr. Hillary was of opinion that the local affection is a consequence of the precursory fever, while Dr. Hendy adopts a very different view of its pathology, and considers the fever to be a result of the topical inflammation; asserting that unless the local affection is severe, there is no fever. In cases where the internal organs are affected, and the functions impaired, constitutional excitement may thereby be excited; but it is difficult to conceive that a febrile affection should be the result of the chronic enlargement of an extremity.

In some respects there is a considerable analogy between erysipelas and the disease in question. During the early stage of elephant leg the external characters of both diseases are similar. The topical affection in either disease rarely terminates in abscess. In erysipelas the inflammation is, however, commonly much more confined to the skin than in this disease; and so far as we are acquainted with the latter affection, it differs from erysipelas in regard to its periodicity, or liability to recur at short intervals, without any appreciable cause.*

Treatment.—The treatment recommended by Rhazes seems to be as consonant to reason, and as consistent with the pathology of disease as any that has been suggested. It consisted of general bleeding in violent cases; emetics, laxatives, a light diet, and confinement to bed. When an inferior extremity was affected, he recommended that the limb should be rubbed with an epitheme composed chiefly of alum and vinegar, and that it should be bandaged from the toes to the knees. The natives of Ceylon seldom resort to any other remedial means in this disease, but keep their couch, or rather their mat, and drink freely of ginger tea. Dr. Musgrave asserts that, "in addition to warmth locally applied, and the ordinary purgative and febrifuge medicines, mercurial saturation of the system was the best means of securing the patient against the erratic disposition, and accordingly ptyalism was the usual *companion* of convalescence from an attack of this very common complaint:" for, he adds, "I am indeed strongly disposed to believe that, since the mercurial treatment has become general, the number of cases, ending in a local or permanent deposition of lymph, has been materially lessened."—"Many individuals subject to this disease, whom I have attended for a number of years, continued to shake off each successive return without retaining the slightest trace of its having existed, or at most with a trifling induration of the inguinal glands."

In the case of a young lady, at Point de Galle, belonging to a family, several of the members of which were affected with this disease, the first attack was treated by the free application of leeches and warm fomentations. Calomel was administered so as slightly to affect the mouth. A second attack which occurred shortly afterwards was treated in the same manner. Effusion did not take place, and no return of the disease was experienced for the two years she was under observation.

When either of the great cavities was implicated, Dr. Musgrave had recourse to the lancet. Some of his medical brethren were afraid to bleed, from an "idea that the inflammation was erysipelatous." He is of opinion, however, that "the redness differs little from that of phlegmon, and suppuration under the form of genuine abscess is an extremely common occurrence; while, on the other hand, external gangrene is rarely, and vesications are almost never observed." Dr. Musgrave seems to have had extensive experience in this disease, and his plan of treatment certainly deserves a trial. It may, however, be observed that, according to his doctrines, ptyalism should be the "*companion*" of almost every disease that occurs in the West Indies.

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* Soldiers and sailors in the West Indies are frequently affected with smart attacks of an ephemeral fever, accompanied with an inflammatory state of the lymphatics of the extremities. The writer of this note has seen, in such cases, a red line from the foot to the groin, indicating the course of the lymphatic trunk.—J. F. EDITOR.

Authors who have described this disease, generally, if not universally, discountenance the amputation of a morbidly enlarged limb. They assert that the constitutional symptoms are apt to recur, accompanied with inflammation of some of the viscera, or of an extremity of the other side of the body. To amputate a limb while the paroxysm of fever continued to return, although at distant intervals, would, in the present state of our knowledge of this affection, be injudicious; but if the recurrence of acute symptoms had ceased for a very long period, we should be much disposed to recommend the removal of a huge, deformed, and perhaps ulcerating mass of leg or arm. The writer amputated the arm of a native of Ceylon on account of an enormously enlarged forearm and hand, similar to the case recorded in the Edinburgh Medical Journal, vol. xiii. page 54, by the late Dr. Kennedy. In this instance the man continued healthy, and no other limb became affected.

Cases have occurred, in which, in consequence of ulceration, a great quantity of a glairy fluid has been discharged, and the morbid enlargement has undergone a reduction to a very considerable extent. An artificial outlet of this kind has been tried in the scrotum, and, according to report, with advantage. Iodine, from the advantage which has been derived from it in goitre, might be tried with some prospect of benefit: the patient should always, if possible, be removed from the district where the disease is endemic.

J. Scott.

Elephantiasis Græcorum. (*Tubercular Elephantiasis.*) Much confusion existed till very lately, in consequence of this term having been applied to two totally dissimilar affections.

The Arabians, we have seen, appropriated the term answering in their language to elephantiasis to an enormously swollen state of the leg; whilst the Greeks designated by it the peculiar tubercular disease which we are about to describe; the appellation being probably suggested to them either by the severity and protracted duration of the disorders, or by the coarseness and insensibility of the skin presenting some analogy to the rough hide of the elephant. The tubercular elephantiasis occasionally, also, received the name *leontiasis* from certain of the old Greek writers, in consequence of a fanciful likeness which they discovered in the stern and wrinkled visage, with its prominent brow and round eye, to that of a lion. It is the *juzam* of the older Arabians, and is still designated by a very similar name not only in Arabia, but also in Egypt, Persia, and India.

The translators of the Arabian writers entailed additional obscurity on a subject already sufficiently involved, by rendering the Arabic word which indicates this tubercular disease, by the Latin term *lepra*, which is properly applicable only to the well-known scaly affection; and the error hence arising has received, even in our own day, still further countenance and circulation, by its adoption in the splendid work of Alibert, and in the invaluable system of Frank.

Elephantiasis of the Greeks is characterized by the existence of numerous flattened glossy tubercles, of a reddish or dark colour, varying in size from that of a split-pea to that of a large nut, and occupying usually the face, ears, or limbs. The skin is irregularly thickened and wrinkled, with a diminution of its sensibility, and a swollen appearance of the affected part. The hairs fall off from almost all parts of the body except the scalp. When a European is the subject of this frightful disease, the whole skin of the parts attacked becomes of a dirty brownish or bronzed colour, approaching to that of a mulatto. As the disease advances, some of the tubercles terminate in resolution, whilst others crack and ulcerate; these ulcerations, however, rarely become either deep or extensive, but furnish a glutinous matter which concretes into solid crusts, beneath which cicatrization usually takes place. The progress of each tubercle is quite independent of those in its neighbourhood, and is unaccompanied with pain, save in the ulcerated state.

One of the most accurate descriptions of the disease is that by Dr. Kinnis, who saw several cases of it in the Isle of France. The face was generally swollen, with large tubercles on the forehead, separated from each other by deep furrows; and smaller and more confluent ones on the cheeks, which occasionally hung down, so as to depress the angles of the mouth; the alæ of the nose were dilated, distorted, and covered with tubercles; the ears thickened, enlarged, and studded over with similar substances, and the lips penetrated by hard whitish bodies, which looked somewhat like recent cicatrices. In mulattoes the tubercles were of a light livid or copper colour, and in blacks a shade deeper than the surrounding skin. The cuticular lines and folds were every where more distinct and larger than natural. "The deeply wrinkled forehead, the bare swollen eyebrows, the heavy pendulous cheeks, the irregular expanded nose, the depressed mouth, and the thickened elongated ear-lobes, combined to render the whole visage singularly harsh and uncouth."

Similar reddish shining tubercles, but of a smaller size, usually exist within the mouth, occupying the palate, uvula, and fauces, and frequently undergo a superficial ulceration: but this is attended with so little pain that the individual is often quite unaware of their existence, even when they are in the ulcerated state. The mucous membrane of the nose is occasionally implicated, being liable to an abundant discharge of matter, to hemorrhage, and even to ulceration. The sense of smell is often totally lost, the breath becomes very fetid, and the nose may eventually be flattened from the destruction of the septum. The frontal sinuses are sometimes attacked, as is indicated by a dull pain in this region; and the voice, in almost every instance, becomes nasal and hoarse, and affords evidence of the larynx being affected. The conjunctiva of the eye occasionally suffers, and the vision becomes in some degree obscured.

The progress of the tubercles on the extremities is altogether similar to that of those on the face; they develope themselves slowly, become inflamed, and subsequently pass into resolution or ulceration. They are most numerous on the external surfaces of the limbs, whilst the inside of the thighs and arms, and the flexures of the joints usually escape. The skin of the fore arms and of the legs is often not only tuberculated, but also scaly and scabbed, and particularly so about the knee and elbow joints.

In the case of a young man which we saw some years ago in the Hôpital St. Louis, at Paris, thin filmy scales were very evident between the tubercles. These existed chiefly on the face and arms, which were of a dirty brown colour, whilst the seat of old ulcerations was marked by still browner discolourations. There was considerable insensibility in some of the diseased patches about the wrist. The case was of old standing, and accompanied by great emaciation and debility. Ulcerations of the alæ nasi and throat had taken place, and the voice was much affected.

But, although a slight degree of scaliness occasionally occurs, as in the above case, it is not a characteristic feature of the disease; for it is neither an original nor a universal symptom.

The feet and hands are usually much swollen, and the motions of the joints greatly impeded by the tubercles. The nails are often coarse and furrowed. The sores are for the most part of an indolent character, with a reddish or a foul surface, little discharge, and hard and irregular edges. When the ulcerations are seated on the fingers or toes, they are apt to sink deep and terminate in gangrene; and a very serious mutilation of the extremities by the sloughing off of one or more of their phalanges is the consequence.

The tubercles very rarely make their appearance on the trunk of the body. The parts attacked become, in a great degree, benumbed, but rarely, if ever, lose their sensibility altogether.

Frank describes the disease as being accompanied with great torpor of mind and sluggishness of body, somnolence, and disturbed sleep. Mental depression amounting to extreme melancholy is the natural consequence of so hopeless a malady. Yet the general health, for a length of time, suffers infinitely less than could have been anticipated; the actions of the respiratory and digestive organs continue long unaffected, and even the cutaneous functions are still tolerably performed, as is evidenced by the abundant perspiration which can be excited by active exercise. The pulse in Dr. Kinnis's cases was generally accelerated and feeble; but others state that it remains throughout the greater part of the disease natural.

The affection has rarely been witnessed by a medical practitioner at its very commencement. In Mr. Lawrence's patient, whose case is detailed in the Medico-Chirurgical Transactions, it seemed to have begun by a general swelling of the head and face, and stiffness of the limbs after a wetting: on the subsidence of the swelling the tubercles began to appear on the ears, face, &c., which were at first of the same colour as the surrounding skin, but became subsequently of a reddish and sometimes of a livid hue.

The progress of the disease is very slow, and its termination, though it may be deferred for many years, almost always fatal, the unfortunate patient being in the mean time dreadfully deformed and mutilated, and literally dying by inches. Recovery is, indeed, a very rare occurrence. In Mr. Lawrence's case the tubercles, it is true, disappeared in a great measure; but from the sudden impairment of the general health, which had been hitherto good, and from the simultaneous occurrence of thoracic symptoms, there was too much reason to apprehend that disease of the lungs had only supplanted that of the skin.

Dr. Adams has described as one of the symptoms of elephantiasis as it occurs in Madeira, a femoral tumour situated in the upper and front part of the thigh. This was absent in the case which Mr. Lawrence has so ably described, but was found by Dr. Kinnis in most of those he had an opportunity of examining — occasionally on one side only, but more frequently on both. It was placed a few inches below Poupart's ligament, and was of an oblong form, as if arising from the enlargement of two inguinal glands, and was about two or three inches in length, and moveable under the skin. At intervals of from one to four months, these swellings were liable to attacks of acute inflammation, preceded by rigor, and accompanied with febrile symptoms, which subsided after three or four days, leaving the tumour nearly as before. These swellings have, however, in one or two instances been known to proceed to suppuration.

As to the *libido inexplebilis* which has been mentioned as one of the features of the disease, a great diversity of sentiment appears amongst the authors who have treated of it. The majority of these (Vidal and Johannis, Bancroft, Niehbuhr, &c.) certainly affirm its existence, but Dr. Adams, on the contrary, asserts that the genitals become wasted; or if the disease come on before puberty, their development is interrupted, as seems to have happened in Mr. Lawrence's case, in which the scrotum was shrivelled up and the testes were unnaturally small and soft; and in the four cases which fell under Dr. Bateman's notice, both the appetite and the power were lost. Dr. Kinnis, on the other hand, who had still more extensive opportunities of observation, did not meet with this wasting of the sexual organs in a single individual, the testes in males and the breasts in females being always of their natural size; and the venereal appetite usually continued in its natural state. Menstruation is recorded to have been regular in two of the affected females, and a third had lately borne, and was still suckling, two children.

From this want of accord amongst persons who have had abundant opportunity of observing the complaint, we are at least justified in concluding that increased sexual propensities are not amongst the essential characteristics of the disease. It is possible that still more extensive inquiry may reconcile the apparent contradiction amongst authors, and show that the tendency to disease in the organs of reproduction may be variously modified by climate, or by peculiar local circumstances, which have hitherto escaped investigation. Alterations in the intensity of these feelings is not a very rare occurrence in some cutaneous affections; and it is not improbable that the extension of irritation and of morbid action to the urino-genital mucous membrane may, in one stage of the affection, give rise to their unnatural exaltation, which may yet be followed, at a subsequent period and more advanced stage, by the very opposite state. Pathology affords many analogous instances, in which a low degree and an early stage of chronic irritation in a secreting organ, leads to its increased action, whilst a higher degree of inflammation, or a more advanced period of the disease, often interrupts its functions altogether, and terminates in the atrophy of its structure.

From a careful review of the evidence, both positive and negative, we are forced to conclude that the affection of the mammary and seminal glands, like the femoral tumour, is at most only an occasional complication.

An account of elephantiasis, in some respects differing from that of other writers, has been given by Mr. Robinson, in the tenth volume of the Medico-Chirurgical Transactions. According to him it is one of the commonest diseases in Hindostan; but there are two distinct varieties, and these have been usually confounded together.

In the first variety, which, from the accompanying insensibility, he proposes to call *E.* anaisthetos, (the Barras of Avicenna and the Soubharry of the natives,) there appear one or two circumscribed light-coloured patches, which are shining, wrinkled, and on a level with the surrounding skin. These occur usually on the hands and feet, and are altogether insensible. They spread slowly till the surface of the whole body may be at length implicated, and its sensibility lost. There is neither pain nor itching, and usually no swelling. After a few months the internal functions become deranged, the pulse gets very slow and heavy, "as if moving through mud;" the bowels grow costive, and there is much sluggishness of mind, and tendency to somnolence. The skin of the extremities becomes fissured and rough, and ulcers appear under the metatarsal or metacarpal joints, the integuments seeming to be simply absorbed, or sloughing off in successive layers of about half an inch in diameter, without any previous tumour, suppuration, or pain. A sanious discharge ensues, the muscle, pale and flabby, is in its turn destroyed, and joint after joint drops off. Yet the miserable sufferer clings to life, eats voraciously, and crawls about with little but his trunk remaining, till he is carried off at length by diarrhœa or dysentery. Mr. Robinson has never seen the larger joints attacked by it, the nose destroyed, or any bones affected save those of the hands and feet. The tuberculated species may occasionally supervene upon this variety, but they have no necessary or constant connection.

The second species he mentions is the tubercular elephantiasis, which commences in the face by florid semi-transparent shining patches of cuticle; the skin becomes irregularly thickened, and gives a bloated appearance to the face and ears. The arms, neck chest, and lower part of the trunk, and the legs, become subsequently affected. The skin of the tuberculated parts is not insensible, but is affected with heat and itching. A frequent sense of weight and pain in the head, with a lethargic state of mind, ensue. The pulse is slow and feeble, the voice hoarse, and the bones of the nose and palate often become carious. It is in this species alone, and in its commencement only, that the venereal passion is increased. In the after stages the testicles are absorbed. The fingers and toes do not, at least till a very late period, become at all numb. Bateman, though his description is in most respects accurate, has, Robinson thinks, in some points confounded these two varieties. The dropping off of the fingers and toes, the insensibility of the skin, and the extreme torpor of mind and body belong to the first; the tubercles, ulceration of the palate, and affections of the cartilages and bones of the face, together with the frequent occurrence of the oblong glandular swelling in the groin, to the second. The mudar, which is so useful in the first species, is injurious in the other; for which last arsenic is the best remedy.

Our knowledge of the morbid anatomy of elephantiasis is still very imperfect both as regards the state of the skin, and of the subcutaneous cellular membrane. The epidermis is extraordinarily thickened, and the tubercles themselves have by some been described as solid fatty tumours rooted in the true skin, whilst others speak of them as small cysts containing a reddish glutinous fluid. The cutis vera has usually been found inflamed in those spots only, when the tubercles were in a state of relaxation and suppuration. The subjacent muscles and tendons have been, in some instances, observed to be matted together. The immediate cause of death has, in most cases, appeared to be the extension of inflammation to the mucous membrane of the trachea and pharynx, and to the lungs.

As to the causes which give rise to this affection, little is with certainty known. Its origin has been ascribed to want of cleanliness and to unwholesome diet, especially the constant use of bad fish; to long-continued exposure to the heat of a tropical sun, by some writers; and to dampness of situation, or occupations requiring the frequent immersion of the limbs in cold water, by others. The number and incongruity of these supposed causes naturally dispose us to attach little credit to any of them. There is strong reason to believe that it is occasionally hereditary. A few instances favourable to the notion of its being propagated by contagion are on record; but, on the other hand, innumerable examples of individuals having been exposed for years with impunity to the closest contact with the diseased, as in the case of husbands and wives, parents and children, &c., throw much doubt on the reality of this mode of origin, and force us to attribute its occasional propagation in a family, either to hereditary predisposition, or to exposure to similar exciting causes, or both.

The disease occurs chiefly in warm climates. Arabia, India, Africa, Madeira, the Isle of France, and some of the West-India Islands, (into which last it is supposed to have been introduced by the slave-trade,) are amongst its chief localities. But northern latitudes do not enjoy a perfect exemption from its ravages, for in Norway and Iceland, elephantiasis, or at least a very similar disease, (*spedalskhed,* radesyge, liktrea,) occasionally prevails.—(See Hufeland's Journal for October, 1819, Henderson's Residence in Iceland, &c.)

The *pellagra* of the Milanese territory, the *rosa Asturica* of Spain; the *Crimean disease* mentioned by Pallas and Gmelin, as occurring in the neighbourhood of Kherson and of Astracan; and the *mal rouge* of Cayenne, are all closely allied to it.

Of the treatment of a disease which is almost always incurable, all that need be said may be comprised in a few words. A mild unstimulating diet, tepid baths, and soothing applications to the skin when in the ulcerated state, are points in the propriety of which all are agreed. The use of sarsaparilla and guaiacum, and of mild alterative doses of mercury with antimony, have, along with change of residence, occasionally produced a temporary amendment.

In the case at the Hôpital St. Louis, to which we have already alluded, though it was in a very advanced stage, considerable improvement was effected by the use of such simple means as the following, viz. confining the patient to a milk diet and mucilaginous drinks, along with minute doses of opium, and baths to allay irritation. This patient was under the care of M. Biett, one of the most enlightened and least exclusive practitioners in Paris; and a great variety of more energetic treatment had previously been employed with no permanent benefit.

All agree that the large employment of mercury aggravates the disease, and this, too, is often the case with arsenic, though in the form of the Asiatic pills, in which it is combined with black pepper, it enjoys a high reputation among the native physicians in the east.

Bark has been extolled by Dr. Thomas Heberden, in Madeira, and the mineral tonics have been recommended by others. Dr. Schilling, at Surinam, found much benefit from the use of the warm bath, and stimulant vapour baths, spirituous frictions, and gentle exercise; and, in truth, the more frequent occurrence of the disease on the extremities than on the trunk, renders it probable, that it is somehow connected with deficient vitality, or imperfect circulation in the skin of these parts, and justifies the employment of such measures.

From observing a temporary amelioration to take place on the occurrence of an erysipelas, and from the fact that the spontaneous subsidence of each individual tubercle is usually preceded by a degree of inflammatory action, it has been ingeniously proposed by Rayer to excite a slight degree of inflammation in the diseased skin by the use of stimulant applications, such as ammoniacal liniments, tincture of cantharides, ointments containing hydriodate of potass, &c. Should their action prove too irritating, he directs us to alternate their employment with that of the warm bath. With the view of promoting absorption, the internal use of iodine might also be tried.

W. B. Joy.

EMETICS, (Φάρμακα ἐμετικὰ, *emetica;* from ἐμέω, *vomo.*) Emetics may be defined—substances which cause the ejection of the contents of the stomach by the mouth, independently of the stimulus of quantity, or of the influence of any nauseous taste or flavour. When these substances, with a few exceptions, are taken into the stomach in certain quantities, they do not immediately operate, but produce an uneasy sensation attended with nausea, which increases, and terminates in vomiting. Even before vomiting commences, the influence of the emetic substance is not confined to the stomach. As soon as the nausea is felt, the countenance becomes pale; and the pulse, diminished in strength and frequency, is quick and irregular. There is occasionally great anxiety, listlessness, and depression of spirits, with a tendency to fainting; at length sweat breaks forth, and just before vomiting commences, a peculiar sensation is experienced at the clavicles. After the vomiting has begun, the face flushes, the pulse is quickened, and it remains so betwixt each effort of vomiting, which occurs several times in succession, at short intervals, before it ceases. The nausea now subsides, either at once or by degrees, leaving a transitory feeling of depression, which makes the patient indifferent to everything around him.

When emetic substances, with the few exceptions to which we have already alluded, are received into the stomach, they do not operate by any local stimulating influence on the coats of that organ; the time which elapses after they are swallowed sets aside such an opinion; and there exist other sufficient reasons for affirming that they are absorbed and carried into the circulation before vomiting is induced. When a solution of tartar emetic is injected into the jugular vein, it produces vomiting sooner than if it had been swallowed; and an experiment of M. Magendie has demonstrated that vomiting produced by an emetic substance may be stopped by pressure made upon the medulla oblongata. Now the inference that may be drawn from this fact is, that the action of emetics is not owing to any local stimulus on the nerves of the stomach, but to the action of the emetic substance, after being absorbed into the circulation, as a direct stimulus to the origin of the nerves, whereby contractions of the stomach, and the actions of the other muscles concerned in the act of vomiting, are induced. These nerves comprehend a branch of the eighth pair, the intercostal, and the phrenic nerves.

It may be inquired — what is the nature of the irritation which excites vomiting? Does it depend on the physical character of the particles of the substance employed? or is it the result of some chemical or electro-chemical change? These are queries which cannot be satisfactorily answered: all that can be said is, that there is, probably, something connected with the substances which cause vomiting, which has the power of irritating a particular set of nerves only: for were this not the case, why should tartar emetic, when injected into the jugular vein, excite vomiting?

Vomiting may be produced by a variety of causes, either connected directly with the stomach itself, or indirectly, by sympathy with it through the medium of the nervous system.

1. Vomiting may be directly induced by food undergoing changes inconsistent with healthy digestion; by mechanical irritants lodging in the stomach; by tumours pressing on the pylorus; by inverted actions of the intestinal canal, forcing

the contents of the duodenum, particularly the bile discharged into it from the biliary duct, into the stomach; by chemical acrids and other poisons, or emetic substances taken into it; by any the mildest substances, when inflammation of its coats, or ulceration, augments its nervous irritability.

2. Vomiting may be indirectly induced by strangulations of the intestinal canal; by the irritation arising from biliary or renal calculi impacted in the excretory ducts of the liver or of the kidneys; by titillation of the fauces; by inflammation of certain portions of the contents of the cranium, for example, of the arachnoid membrane covering the base of the brain; by repelled cutaneous eruptions; by emetic substances injected into the veins; by sailing, swinging, riding in a carriage, and other movements of the body; by pregnancy; by the influence of certain odours; and by mental impressions. Whichever of these causes produces vomiting, a specific action of the stomach, and the consent of certain muscles of the thorax and the abdomen are, in every instance, necessary to produce the effect: thence the question, in what manner is vomiting effected? In replying to this query, let us first enquire what opinions have been advanced regarding it by others.

M. Chirac (Histoire de l'Académie des Sciences, 1686) first suggested the opinion that the stomach is passive during vomiting, which he contends is effected solely by the action of the diaphragm and the abdominal muscles; an opinion afterwards adopted by Duverney, Bayle, and John Hunter. M. Litre denied the influence of the abdominal muscles, and maintained that the diaphragm is the chief agent in producing vomiting. Lieutaud and Haller supported the idea that the stomach is the real agent; the former founding his opinion on having observed, in a patient who could not be made to vomit by the most powerful emetics, that the stomach was greatly distended and insensible. Sir Charles Bell (Anatomy of the Human Body, vol. iv. p. 54) appears to hold nearly similar opinions to those of Lieutaud upon this subject. "That vomiting," says he "may be produced by the inverted motion of the stomach and diaphragm alone, is apparent from experiments upon living animals, where the abdominal muscles are laid open, and from cases in which the stomach has rested in the thorax, and yet been excited to active vomiting." He also states that the walls of a stomach in his possession "had become so thick that they could no longer suffer contraction by the muscular fibres; the consequence of which was, that although the inner coat of the stomach was in a raw and ulcerated state, there was no vomiting." Sir Charles, however, modifies this opinion by remarking "that, when the stomach is excited to vomiting, there is consent of the abdominal muscles, by which they are brought into violent spasmodic action; not alternating in their action, as in the motion of respiration, but acting synchronously, so as greatly to assist in compressing the stomach; but," he adds, "at the same time, the action of these muscles, however forcible their contraction, cannot alone cause vomiting; nor has this action any tendency to produce such an effect on other occasions, in which the utmost contraction of the diaphragm and abdominal muscles is required to the compression of the viscera."

M. Magendie, in an able memoir published in 1813, supports the opinion of Chirac. (See also Précis Elémentaire de Physiologie, vol. ii. p. 140.) In one of his experiments, he drew the stomach through an opening of the abdomen, thus freeing it from the influence of the diaphragm and abdominal muscles, and he found that vomiting could not be excited. He also ascertained, that if all the abdominal muscles be removed, leaving only the linea alba, vomiting still occurs from the stomach being pressed, as he supposes, between that part and the diaphragm. In another experiment he states that he substituted a pig's bladder for the stomach, and nevertheless, vomiting took place! He found that the division of the phrenic nerve weakens the action of vomiting, but does not altogether prevent it.

These experiments prove—1. that the influence of the nervous system is essential to the production of vomiting; 2. that the abdominal muscles greatly influence the ejectment of the contents of the stomach. But they do not satisfactorily explain the action of the diaphragm, nor the part which the œsophagus bears in the operation of vomiting. Dr. Richard Harrison, in his Gulstonian Lecture, adopts the opinions of Chirac and Magendie, as far as regards the action of the diaphragm and the abdominal muscles; but he adds to this call upon the expiratory muscles through the agency of the brain, and their consequent action, the contraction of the stomach itself. There can be no doubt of the agency of the nervous system in this operation; the only question is, whether the excitement be first exerted on the extremities of the nerves of the stomach itself, from which the impression is communicated to the brain by sympathy, and the auxiliary muscles be thus called into action: or whether, as the writer of this article imagines to be the case, the impression is made upon the spinal marrow from the absorption of the emetic substances, and through the influence of the motor nerves to the respiratory muscles, so that all the machinery concerned in the operation is excited into simultaneous action.

Dr. Marshall Hall has endeavoured to prove that Magendie's assertions respecting the influence of the diaphragm are incorrect, and that the act of vomiting is in fact a forcible expiratory effort. He contends that, if the diaphragm contracted, as Magendie affirms, the act of vomiting would be attended by inspiration; that the glottis, in such a case, would necessarily be open, and that the fluids ejected from the stomach would be drawn into the larynx, and induce great irritation there; an event which does not occur in vomiting. On the contrary, as M. Magendie admits, although he contends for the agency of the diaphragm, the larynx is accurately closed at the instant that the vomited matter is passing through the pharynx. Dr. Hall's explanation of the mechanism of vomiting is this: "the contents of the thorax and abdomen are subjected to sudden and almost spasmodic contraction of all the muscles of expiration, the larynx being closed so that no air can escape from the chest, and the two cavities being made one by the floating or inert condition of the diaphragm." The mere mechanism of vomiting, therefore, according to Dr. Hall, "differs little from that of coughing, by which indeed the contents of the stomach are frequently expelled: the larynx in the former is, however, permanently, in the latter, only momentarily closed; and there is doubtless a different condition of the cardiac orifice and of the œsophagus." In order to confirm his opinion, Dr. Hall made an opening into the trachea of a dog, which was excited to vomit by subsulphate of mercury; during the act of vomiting, the air from the lungs was forcibly driven through the artificial opening. Dr. Hall, in his explanation, admits the influence of the œsophagus, and adds, "it is plain that the cardiac orifice must be freely opened; for mere pressure upon the viscera of the abdomen will not, in ordinary circumstances, evacuate the contents of the stomach. To effect this open state of the cardiac orifice, it is probably necessary that the diaphragm should, indeed, be in a relaxed rather than in a contracted state." There is much ingenuity and considerable truth in this theory; but it does not wholly explain the operation of vomiting. The following opinion of the writer of this article may be regarded as a modification of that of Dr. Hall.

He admits that it is true that the glottis is closed, and that a powerful effort is made as if of expiration; but this effort is not altogether that of expiration; for, whilst there is a powerful and sudden contraction of the abdominal muscles, forcing up the whole contents of the abdomen towards the thorax, the diaphragm is fixed, owing to the closing of the larynx, and the retention of the quantity of air which the lungs contained at the commencement of the effort. The diaphragm is thus prevented from ascending into the chest; and the pharynx being drawn up as in the act of deglutition, opens the cardiac orifice of the stomach, and forms with this viscus one continuous cavity. This open state of the cardiac orifice of the stomach, forming one continuous cavity of the stomach and pharynx, explains an observation of M. Magendie, that "during the state of nausea which preceded vomiting, in some of his experiments, air was drawn into the stomach." Now, if it be true that the cardiac orifice of the stomach is open, and the mouth, the œsophagus, and the stomach be one continuous cavity, it is evident that the external air, which is heavier than the air and vapour contained in the stomach, will necessarily be forced into this organ by its mere gravity, as it would be into an ordinary receiver containing vapour and little or no air. In this state, by the sudden compression of the stomach by the abdominal muscles drawn forcibly and suddenly inwards, the diaphragm being fixed, the contents of the stomach must be directed upwards, with a degree of force commensurate to the suddenness of the pressure upon its walls; and consequently they are thus ejected by the mouth. If this description be correct, it is evident that the act of vomiting is the result of the simultaneous action of all the muscles of respiration, at a moment when the glottis is shut, and offers resistance to the ascent of the diaphragm. Dr. M. Hall is correct in describing it as an expiratory effort; but this effort alone would not effect vomiting, were there not the resistance which has been described opposed to it. The stomach, therefore, is in every respect passive; and it is not obvious that contraction of that organ forms any part of the process of vomiting; it is rather in a state of relaxation than of contraction. Thus, if a bag half filled with fluid, with an open tube rising from it, were suddenly struck or compressed, the fluid would be ejected through the tube; but if, at the same time, the bag was also contracting its general capacity, the impulse of the compressing force would be necessarily diminished, and the impetus of the ejectment of the fluid considerably weakened.

Such is the view of this operation taken by the writer of this article: but in whatever manner it is accomplished, there can be only one opinion respecting the share which the nervous system has in the operation. "This act, (vomiting,) will not take place," justly remarks Dr. Paris, "however forcibly the stomach may be goaded by emetics, where the energy of the nervous system is suspended, as in cases of profound intoxication, or in violent wounds or contusions of the head; while, if the brain be only partially influenced, as by incipient intoxication, or by a less violent blow upon the head, its irritability is increased instead of being paralysed, and vomiting under such circumstances is excited by the slightest causes." (Pharmacologia.)

The first effect of the influence of an emetic on the system is the production of nausea, and a consequent diminution of general excitement: this is followed by the ejectment of the contents of the stomach, and an alteration in the condition of its secreted fluids: thus, for example, in dyspepsia not only do emetics eject any superabundant acid contained in the stomach; but they also so influence the functions of the secreting follicles, that for some time all acid totally disappears. Along with the contents of the stomach, bile is also generally ejected, owing to the compression of the liver and the gall-bladder forcing a large quantity of this secreted fluid into the duodenum and the stomach. In the act of vomiting, also, all the abdominal viscera being compressed, the blood is propelled more forcibly through their vessels; thence a change is effected on the intestinal secretions, and on those of the pancreas and the spleen: even the kidneys are affected, and the quantity of urine is considerably increased. The pulmonary system is also influenced, a freer circulation of the blood through the lungs is promoted, and the action of the secreting and exhalent vessels is augmented. But, besides these effects of emetics on the particular organs, the result of their influence on the general system is the equable distribution of the blood to every part of the body; and the consequent removal of local determinations and congestions. How far these effects depend in part upon the absorption of the emetic substance is yet to be ascertained.

Emetics operate as evacuants in other respects than by emptying the stomach: they induce diaphoresis, and by stimulating the capillary system, and thereby checking the effusion of serous fluids into the cavities of the body, enable the absorbents to carry off any fluid already accumulated there: hence their utility in dropsical affections. By the nausea, also, which attends their operation, abating the force of the circulation, they have sometimes proved useful in active hemorrhages.

Although all the substances classed as emetics accord in producing more or less nausea and vomiting, yet they differ in some circumstances.

1. *Emetics differ in the time required for producing their effects.*—The sulphates of zinc and of copper operate the quickest of all the emetic substances in common use, exciting vomiting almost as soon as they are swallowed. Tartar emetic, and the other active antimonial preparations, and subsulphate of mercury, operate quickly also, but less so than the salts of zinc and of copper; whilst all the vegetable emetics are still more tardy in producing vomiting. This diversity in point of time has not been satisfactorily explained: it has been supposed to depend on the solubility of the emetic substance in the gastric juice, and its consequent application to the extremities of the nerves of the stomach being thus more or less facilitated. But, independently of the fact that all emetics, with the exception of the few which operate by their direct influence on the nerves of the stomach, are absorbed before they produce their effects, there is no evidence of this action of the gastric juice; and substances already in a state of solution are influenced by the circumstances, whatever these may be, which produce this diversity. Two substances held in solution in the same solvent, and conveyed into the stomach under the same circumstances, differ considerably in the time which elapses before they operate. Thus a solution of tartar-emetic in wine operates sooner than a vinous solution of ipecacuanha; although, were both these substances in the solid state, and were the action of the gastric juice on them requisite for their operation, it is probable that the vegetable substance would be the most readily dissolved, and consequently operate most quickly; but the reverse is the case. It is probable that the diversity depends on the more rapid absorption of the antimonial salt than that of the emetina, the active principle of the ipecacuanha, after both have passed the pylorus. The time required for the operation of different emetics should be familiar to the physician, as much of the benefit to be expected from this order of remedies sometimes depends upon this circumstance.

2. *Emetics differ in the degree and the severity of their effects.*—The saline emetics in general operate more violently than the vegetable emetics; but the latter cause a more severe and longer-continued nausea. It is not easy to account for these effects, unless we admit that, although the first impression of the saline emetic on the nervous system be the most energetic, yet, that the saline substance is more readily decomposed, or thrown out of the system, than the vegetable.

It is of much importance, in a practical point of view, to attend to the degree of energy of operation of different emetics, and to avoid any risk connected with their violent action. Emetics do not operate with much energy on persons of torpid habits; larger doses are required than in ordinary cases; and, not unfrequently, vomiting cannot be excited by any dose. When this is the case, emetics cause great anxiety and uneasiness. Persons of a sanguine habit are more easily affected by emetics than those of a melancholic; women than men; children than adults: thence experience has informed us that, in febrile affections, vomiting is a common symptom in such persons. It is of some importance to know how to anticipate the degree of difficulty or facility with which different persons can be excited to vomit, seeing that not only those who are not easily excited suffer from pain and anxiety, but those who are very easily affected are apt to be injured by even the ordinary dose of an emetic.

Emetics are contra-indicated in some conditions of the system. In all cases in which the phlogistic diathesis prevails, they ought not to be administered until after bloodletting and purging have been employed. They have, nevertheless, been found very beneficial in some inflammatory affections. In croup they are supposed to be specially indicated: Dr. Crawford, and many subsequent writers on that disease, recommend them to be administered in the earliest stage of it: others, however, urge the propriety of waiting until the inflammatory action be at least mitigated by the use of the lancet, calomel, and purgatives. In those cases in which we have seen them employed in the commencement of the disease, much less assistance has been required from bloodletting than when they have not been given. We must admit, however, that when the inflammatory symptoms run high, they are at least of doubtful efficacy. In pneumonic affections, also, if the state of the bronchial cavities require the influence of an emetic to aid expectoration, they ought not to be employed until after the excitement has been reduced by the proper use of the lancet. As pressure is necessarily applied to the descending aorta during the action of vomiting, there is a temporary interruption to the pulmonary circulation, and the blood is returned with difficulty from the head; consequently vomiting should not be excited in states of the habit predisposing to apoplexy. From the compression, also, of the abdominal viscera, the administration of emetics requires caution in those afflicted with hernia and prolapsus of the anus or of the uterus; nor are they always admissible in the advanced stage of pregnancy. The spontaneous vomitings which attend the early stage of pregnancy are sufficient guarantees of their safety at that period. In diseases of debility, and in weak and delicate subjects, emetics, especially those which nauseate, should be carefully avoided. Experience has also proved that the frequent employment of emetics is injurious, producing general debility, and such an irritable state of stomach that it is excited to vomiting by the most trifling causes, even by changes in the nature of the food; indeed no means are so likely to induce dyspepsia as the custom of taking frequent emetics.*

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* This remark is, apparently, at variance with the custom of the Romans. Emetics were daily taken to enable them to relish the enjoyments of the table; and so far did the Romans carry this custom, that they sometimes excited vomiting to eject from the stomach what they had eaten in one course, that they might be the more capable of enjoying what was to follow. According to Seneca, "they vomited that they might eat, and ate that they might vomit." They employed emetics before meals, that they might be able to eat more plentifully; and they often concluded a feast with an emetic, to prevent the consequences of gluttony. In one of Cicero's epistles to Atticus, he describes a visit which he

With respect to the period of the administering emetics, much must depend on the circumstances of the case which demand their employment.[*] If there be no immediate urgency, the evening is the best time; for as the body is always more or less exhausted by the operation of an emetic, the tendency to sleep which supervenes can then be readily indulged. Attention to the period for administering emetics is particularly requisite in febrile affections. Thus when they are necessary in continued fever, the time of day for administering them with most advantage must not be overlooked. In almost every continued fever there is a mid-day and an evening exacerbation. These are not always very obvious: the evening one, however, is the most so; and its approach is marked by increase of pulse, thirst, headach and dry hot skin. It is immediately prior to this accession that emetics will be found most useful, sometimes checking it altogether, at other times at least diminishing its violence.

In reference to the operation of emetics, we may remark that the dose of the emetic substance should be sufficient to produce full vomiting, otherwise nausea and restlessness, instead of vomiting, will follow the administration of the medicine. It is the custom to order warm water to be freely drunk during the operation of an emetic. This certainly promotes its action if the fluid be taken after each time of vomiting; but it is requisite to be cautious that too much is not taken at once. The stomach, when oppressed with water, does not yield to the action of the muscles which are excited to produce vomiting, thence it is in danger of laceration. There are several instances on record of this having occurred; but it may be questioned whether rupture ever happened, unless the organ was previously diseased? The quantity of fluid for an adult should not exceed two-thirds of a pint at a draught; it should be tepid, and, if the stomach be weak, some bitter infusion, as, for instance, that of camomile flowers, or a few drops of liquor ammonia in the water, should be employed to aid the action of the emetic. If the vomiting be severe and long-continued, it may be checked by solutions of neutral salts; sulphate of magnesia, for example, or citrate of potassa, formed with the carbonate of potassa and *fresh* lemon-juice, given in a state of effervescence; or a teaspoonful of magnesia may be given in a glass of sherry; or solid opium or hydrocyanic acid may be administered in small doses.[†]

All substances employed to excite vomiting may be arranged in two classes—*direct* and *indirect* emetics.

I. **Direct Emetics** are substances which cause vomiting by an immediate impression on the nerves of the stomach. It may be asked, how can this take place, if the stomach be a passive agent in the act of vomiting? We reply, that by the term passive agent we do not mean to assert that the stomach is insensible to the stimulus of all emetic substances; on the contrary, all irritants, whether chemical or mechanical, are capable of stimulating the stomach to vomiting; but, nevertheless, in this operation, the stomach is not the active agent. This seeming inconsistency may be thus explained. When the stomach is in the performance of its natural function, the digested food is pushed forward to the pyloric orifice; but if the chymification be not complete, it is again thrown back into the fundus, and occasionally into the pharynx, producing eructation; a circumstance, however, which occurs only when the secreted juices of the stomach are in a morbid state; and, under this condition, the ejectment resembles in every thing but degree that produced by emetics. In a similar manner, when a large dose of sulphate of zinc, for instance, is swallowed, its immediate application to the nerves of the fundus of the stomach produces a spasmodic contraction there, which throws the whole contents of the viscus mixed with the sulphate upon the pylorus; but these are as rapidly returned, even before the relaxation which must follow the spasmodic contraction have taken place; and by this means, the emetic substance being applied to the nerves of the cardiac portion of the stomach, the muscles and every other part necessary for effecting vomiting are simultaneously called into operation, and vomiting takes place. This is the opinion of the writer of this article, and he conceives that it is the only theory capable of explaining the immediate emetic influence of sulphate of zinc, sulphate or acetate of copper, and carbonate of ammonia. These substances, when taken into the stomach, first hasten, in a spasmodic degree, that action of the organ which carries the food forward to the pylorus; and there acting *contra naturam*, instead of opening the pyloric orifice, they are thrown back upon the cardiac portion of the stomach, the nerves of which being suddenly impressed, call into play all those sympathies which operate to produce the action of vomiting. If this theory be admitted, it may be applied to explain not only the vomiting caused by powerful irritants when swallowed, but those also which occur in cancerous affections of the pylorus, and in the early stages of pregnancy. Thus, in cancer of the pylorus, when food is taken into the stomach, no vomiting occurs until it is pushed forward to the pylorus, which, being morbidly excitable, throws back the food mixed with acrid matters, the result of the disease, and these acting on the sentient extremities of the eighth pair of nerves spread on the cardiac portion of the stomach, the muscles of the abdomen and those of respiration are instantly called into action to relieve the stomach of the offending matter. In pregnancy, again, the sympathy between the stomach and uterus is such, that the disturbance of the former is in the direct ratio of the energy of the latter; digestion, therefore, becomes depraved, the chyme is imperfectly formed, and, mixed with the acrid secretion, is thrown back from the pylorus, and applied to the cardiac nerves, and vomiting is necessarily excited.

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made to Cæsar, at his villa near Rome; and states that his dignified host paid him the compliment of taking an emetic before dinner, when he understood that Cicero intended to spend the day with him.

[*] Some of the old writers, Stoll in particular, regard the period of the day as a matter of indifference. Rat. Med. 11.

[†] Many other means may be employed to check vomiting; as, for instance, the administration of subnitrate of bismuth, infusion of calumba, strong coffee, tincture of capsicum diluted with water, in that induced by pregnancy and sailing;—a large dose of calomel, and dry cupping on the epigastrium.

Substances which act in the manner just described are those which constitute *direct emetics*. Their operation is preceded by no nausea, neither is any left behind after it is completed. Emetics of this division, therefore, are adapted for producing full and immediate vomiting, in those conditions of the habit in which the exhaustion caused by nausea would be injurious, but in which it is nevertheless necessary to unload the stomach. They are also the most useful in cases of poisoning, not only on account of the rapidity of their operation, but from their action not being followed by absorption, which, in such instances, would prove highly prejudicial. Direct emetics are few in number, and are all inorganic substances.

1. *Ammonia.* If the officinal solution of *ammonia*, to the extent of half a fluidrachm, be swallowed in a cupful of cold water, and the same quantity of tepid water be taken immediately afterwards, it excites instant vomiting. But as untoward circumstances have occasionally followed the administration of the solution of pure ammonia, it is rarely employed as an emetic; the carbonate, in doses of from ʒss to ʒi being given in its stead. It has been found serviceable in those cases of chronic catarrh, in greatly debilitated habits, in which expectorants cannot with propriety be administered. In such a state of the system, the act of vomiting, induced by the ammonia, aids in unloading the bronchial tubes, whilst, at the same time, a salutary stimulus is given to the nervous system; and the expectoration, which in general is suspended in such cases, is again brought on. When administered in larger doses, ammonia operates as an irritant poison, and requires the immediate administration of vinegar to neutralize and obtund its acrimony. (See TOXICOLOGY.)

2. *Sulphate of zinc.* This is a more safe direct emetic than ammonia, and equally powerful in its effects. It excites no nausea, and operates as soon as it enters the stomach, producing a single but copious ejectment: it is, therefore, well adapted for cases of poisoning, and to excite vomiting in the commencement of the paroxysm of ague, when we are desirous of breaking the morbid association which keeps up the disease, by giving such an impulse to the system as will propel the blood to the surface, and equalize the circulation. In cynanche tonsillaris, when abscess forms in a situation which cannot be readily reached by the knife, and yet does not seem disposed to break, as the object of prescribing an emetic is merely to burst the abscess, the sulphate of zinc is to be preferred to any other substance. The dose of the sulphate to produce full vomiting is from ℈i to ʒss. If an overdose have been taken, the best antidotes are cretaceous mixtures, milk, and albumen, after the use of the stomach pump.

3. *Salts of copper.* Both sulphate and acetate of copper operate as powerful direct emetics. They have been employed in the incipient stage of phthisis; and it is a curious fact that in this disease the sulphate will sometimes lie in the stomach for upwards of half an hour without producing vomiting, and then operate at once, and as forcibly as when it acts in the usual manner. We may here be permitted to remark, that emetics have been regarded as specifics, and have been prescribed in every stage of this disease. "It is remarkable," says Dr. Young, "that a very great majority of the cures of consumption, which are related by different authors, have either been performed by emetics or by decidedly nauseating remedies." (Young's Practical and Historical Treatise of Consumptive Diseases, &c. p. 65.) They were employed in this disease by Hippocrates, whose emetic was a compound of honey, vinegar, and water; (Hippocrates on Int. Aff.) and by Galen, who followed the example set by the father of physic. Bennett, Morton, Etmuller, Wainwright, Russell, Bryan Robinson, Marryat, Donald Monro, Macbride, and many other equally distinguished physicians speak also favourably of their effects. The confidence of Dr. Reid and Dr. Simmons in the use of emetics in phthisis was unbounded. Dr. Mackittrick Adair held almost as sanguine an opinion of their beneficial influence as Dr. Reid: he gave first a pint of warm water, then a grain of sulphate of copper with a drop of dilute sulphuric acid in half an ounce of water every other evening for three days; then every morning. (Duncan's Commentaries, 1791; p. 473.) Notwithstanding these strong testimonies, truth obliges us to state, that the method of treating phthisis with emetics has not succeeded in our hands, nor in those of many of the most distinguished men who, at different periods, have adorned the profession. If emetics, however, be employed, those which operate directly, the sulphates of zinc and of copper, should be preferred. The dose of the sulphate of copper is from ten to fifteen grains dissolved in three ounces of water. In cases where it has been overdosed, the best antidotes, after the use of the stomach-pump, are ferrocyanate of potassa, milk and albumen.

II. **Indirect Emetics** are obtained both from the organic and inorganic kingdoms of nature. Indeed, whatever disturbs the energy of the brain to a degree sufficient to affect the stomach by nervous sympathy, and to call into action the muscles necessary to establish the act of vomiting, may be regarded as an indirect emetic. Thus the mechanical irritation of the uvula and velum of the palate with a feather or with the finger; the motion of a carriage, swinging, whirling, sailing, and many narcotics, produce nausea and vomiting; and the same effects result from inhaling some gases.

Among the organic substances which operate as indirect emetics are some varieties of acrid oil, in combination with resin and other principles, as found in the cotyledons of sinapis *nigra*, the flowers of anthemis *nobilis*, and the leaves of asarum *Europæum*.

1. *Mustard.* A table-spoonful of flour of mustard mixed in water forms a ready and useful emetic, in cases which admit of stimulants: it operates quickly, and with less nausea than the direct emetics. This dose is rather large if the flour of mustard be genuine; but that usually sold in the shops contains, according to Dr. Paris, one-sixth part only of genuine mustard. Emetics of flour of mustard are useful in cases of intoxication threatening apoplexy, as the stimulant pro-

perty of the mustard proves beneficial after its emetic operation is over. In the atonic form of gout, also, in which no irritation is more hurtful than that arising from crude undigested matters in the stomach, a mustard emetic may prove highly beneficial, or at least the substance employed to excite vomiting, in such a case, should be of a warm stimulant kind, the operation of which is not followed by debility. For the same reason, no emetic is so well suited for cases of malignant cholera as mustard.

2. *Camomile Flowers.* A strong tepid infusion of these flowers is powerfully emetic, when administered in doses of from f.℥iii to f.℥iv; and a weaker infusion is well adapted for promoting the action of other emetics, when the stomach is weak and likely to be oppressed by the use of tepid water.

2. *Asarabaca.* This plant owes its emetic property to a combination of acrid oil and cytissina.[*] It is very seldom employed, as it loses much of its emetic power by drying and keeping.

4. *Emetina* [*Emetia*]. A more common indirect emetic than either of the three substances already mentioned is *emetina*, as contained in the roots of ipecacuanha, (cephaelis ipecacuanha.[†]) This principle operates more quickly as an emetic than the root which yields it, and its action is followed by sweating and a tendency to sleep. It has not been much employed in this country, but the French physicians prefer it to ipecacuanha. It is ordered in a solution of four or five grains in six fluidounces of water, of which two fluidounces are ordered to be taken every half hour until full vomiting is procured. That it operates on the nerves through the medium of absorption has been demonstrated by injecting a minute portion of it into the jugular veins, the cavity of the pleura, the tissue of the muscles, and the anus of a dog; in all of which modes of applying it, vomiting is produced. If it be over-dosed, dangerous, sometimes fatal effects ensue: when the latter occur, it excites inflammation of the mucous membrane of the alimentary canal, and the lungs are found gorged with blood, and approaching to hepatization. The best antidote is infusion of galls, which, by forming an insoluble precipitate with the emetina, neutralizes and renders it inert.

5. *Ipecacuanha root*, radix cephaelis ipecacuanha, which owes its emetic properties to the principle just described, has been known in Europe as an emetic since the middle of the seventeenth century.[‡] It is administered in the form of powder, infusion in water, and solution in wine. The powder is the cortical part of the root, the central or ligneous part being inert: it should be of a bright grey colour, have a nauseating disagreeable odour, and a bitter acrid taste which remains in the throat.[§] In doses of from ℈i to ʒss it produces full vomiting. If ʒss of the powder be triturated with f.℥vi of water, and f.℥ii of the solution administered at the distance of half an hour, full vomiting generally follows the second dose. The vinous infusion is chiefly ordered for children in doses of f.ʒii, repeated every fifteen minutes until vomiting be produced.

When ipecacuanha in any form is taken into the stomach, its first effect is on the mucous membrane, as a local irritant: it is, however, partially digested in the stomach, and the emetina thus separated is absorbed and produces that simultaneous action of the muscles of the abdomen, the thorax, and the diaphragm, which constitutes vomiting. But, sometimes, in the largest doses, it fails to produce this effect; a circumstance, which, if the drug be genuine, can only be attributed to idiosyncrasy. In administering ipecacuanha, or its active principle, as an emetic, it may be given with the intention of either simply unloading the stomach, or of acting sympathetically on more distant organs after it has performed its emetic effect. When prescribed with the first intention, it frequently operates also on the bowels, owing to some of it being forced beyond the pylorus in the first effort of vomiting; and on this account, when added to jalap, the purgative properties of this drug are much augmented. When it is desirable to extend its action after vomiting, this part of its operation should be less aided with tepid water than when vomiting only is required; the result is a powerful determination to the surface and copious perspiration, from the continuation of nausea after its emetic effect has ceased. The question has frequently been discussed, whether ipecacuanha and tartar-emetic may be indifferently employed as an emetic? The answer is not difficult. In choosing between these emetic substances, we must be guided by the condition of the system, and the nature of the disease, as well as the intention for which the emetic is prescribed. In intermittents, if the frame of the patient be delicate, ipecacuanha is to be preferred; if it be robust, capable of bearing full vomiting with impunity, and without suffering from the subsequent debilitating effects of profuse sweating, the antimonial preparations will be found most useful. In continued fever, in selecting an emetic we must not only prefer that which will produce full vomiting, but which will excite also that state of the surface which may act as a crisis; consequently the tartrate of antimony and potassa is preferable to ipecacuanha. The influence of nausea in checking hemorrhages has been well established; but the superiority of ipecacuanha over all other emetics in those connected with the uterus, has only lately been established by the experiments of M. Caffin, (Journal Général de Médecine, vol. lxix,) and Dr. Osborne, of Dublin. (Observ. on the Employment of Ipecac. in Menorrhagia.) The latter found that in doses of a scruple taken in the evening, and followed by an acidulated saline purgative next morning, the discharge in menorrhagia ceased in twenty-four hours; and when it returned after a short interval, the repetition, once or twice, of the ipecacuanha emetic never failed to render the cure permanent. Dr. Osborne's experiments were conducted in Sir P. Dun's Hospital: in several of the numerous cases treated in this manner, the ipecacuanha arrested the discharge after tartar-emetic had produced no beneficial effect: and its influence was not modified either by a full pulse, with much excitement, or in a greatly weakened state of the system. In dysentery the superiority of ipecacuanha, when full vomiting is required, was determined by a set of experiments made by Sir George Baker. (Trans. of the Royal College of Physicians of London. vol. ii.) Finally, ipecacuanha is preferable in every instance in which the powers of the stomach require to be maintained, and yet vomiting is requisite; and in cases in which a chronic diarrhœa exists, there can be one opinion only as to its superiority over tartar-emetic.

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[*] This peculiar principle received its name from having been first obtained from the seeds of the cytissus *laburnum* by MM. Chevallier and Lassaigne. In a separate state it is of a yellow colour, has a nauseous bitter taste, attracts moisture from the air, dissolves readily in water, less so in alcohol, and is totally insoluble in ether. It is better known from its negative than its positive qualities, as none of the re-agents which usually precipitate bitter vegetable infusions make the least change in it; nor does it display either acid or alkaline properties.

[†] *Emetina* is procured from ipecacuanha by treating the powdered root with cold distilled water until it ceases to take up any more soluble matter. This watery infusion is then to be concentrated by evaporation in a water bath; subcarbonate of magnesia added to it in excess, and the evaporation continues to dryness; after which it is to be treated with strong alcohol, and the extract thus procured again treated with water, and evaporated to dryness. In its pure state emetina is white, pulverulent, unalterable in the air, scarcely soluble in cold water, soluble in hot water and in alcohol, but not in ether. Its taste is slightly bitter, and it displays alkaline properties. It is usually, however, procured in the form of brown scales, semi-transparent, with an odour resembling caromel, and a bitter, slightly acrid taste. It is a compound of carbon, hydrogen, oxygen, and nitrogen. Gallic acid, and infusion or tincture of galls precipitate from its solutions in an insoluble form; and it is also thrown down by tincture of iodine, subacetate of lead, bichloride of mercury, and muriate of tin. When it is separated from the ipecacuanha, what remains is inert. It was discovered by M. Pelletier in 1817.

[‡] The name of the root is a compound of two Peruvian words, *ipe* signifying root, and *Cuanha* the name of the place where it was first found.

[§] Owing to a peculiar idiosyncrasy, some persons are affected with severe dyspnœa by the odour of ipecacuanha. (See ASTHMA.)

Although the usual dose of ipecacuanha is from ℈i to ʒss, to promote full vomiting, yet this must vary considerably in reference to sex and temperament. The dose for a young infant is gr. i; for a child of from six to ten years of age, grs. x; and for the youth of either sex under twenty, from gr. xiv. to ℈i.

With respect to the propriety of substituting emetina for ipecacuanha, some advantages might result from doing so; its effects, as an emetic for instance, are more certain, and its use is generally followed by sweating and a tendency to sleep. The dose of the emetina is small, not exceeding gr. v. for an adult; and as it is very soluble in water, it can be more readily administered in divided doses than ipecacuanha. Besides, the powder of ipecacuanha loses much of its activity when kept for many months, whereas emetina is not at all altered by keeping.

6. *Squill*, scilla *maritima*.—The bulb of the squill, when properly dried, possesses considerable emetic powers, which are said to be attributable to a peculiar principle named *scillitina*;* but this is a compound substance, containing, besides the active principle of the squill, sugar, and traces of citrate of lime. Ether, when digested on squill, and evaporated afterwards on water, leaves on the surface a thin pellicle, intensely bitter, whilst a soluble matter mingles with the water: this pellicle is the real active principle of squill. Squill is seldom employed as an emetic; but in cases where its emetic influence is no objection and does not interfere with its expectorant powers, as in hooping-cough, croup, and some other pulmonary diseases, it is found useful. When emetics are thought to be serviceable in ascites and anasarca, squill has been supposed to be particularly indicated, but it is in no respect superior to tartar-emetic in such cases. It is given in the form of powder, in doses of from grs. iii. to gr. xii; or, in that of tincture, from *m*.xxx. to f.ʒi, repeated at intervals. When overdosed it operates as a narcotic-acrid poison, causing violent vomitings, diarrhœa, tormina, bloody urine, tetanus, and a cuticular eruption resembling uticaria: in some habits these effects result even after a small dose of the medicine.

7. *Tobacco*, folia nicotianæ *tabaci*, displays powerful emetic properties, whether it be taken into the stomach, inserted into the rectum, or applied to the surface of the body; but its operation is too difficult to control to permit it to be prescribed, under any circumstances, as an emetic. It is mentioned merely because it has lately been recommended as a remedy in dropsy. In the event of its use producing poisonous effects, it is proper to know that infusion or tincture of galls renders the infusion of tobacco inert, and consequently should be instantly administered.

Inorganic emetics.—The first of these necessary to be noticed, is the *tartrate of antimony and potassa*, a salt which has been employed as an emetic since 1631.† As an emetic, it operates through the medium of the nerves, and probably never until it reaches the circulation. It proves emetic, or purgative, or sudorific, according to the frequency of the dose: thus a grain, dissolved in a moderate quantity of water, given every ten or fifteen minutes, produces full vomiting; the same quantity repeated every three hours may vomit once, but it afterwards purges; and if administered once in six hours only, it causes copious diaphoresis. It is the best of the emetic substances for producing full vomiting at the commencement of continued fevers, and in all cases where it is of advantage to keep up a state of nausea. In mania it is preferable to all other emetics; but it requires to be prescribed in much larger doses than in most other diseases, a scruple often producing little effect whilst the state of congestion of the brain remains; but if the lancet have been previously resorted to, a grain or two grains will produce full vomiting. In melancholia the direct emetics are to be preferred, as the nausea which follows the use of tartar emetic is in this instance injurious, by augmenting the collapse which always occurs in this disease.

When overdosed, besides operating as a powerful emetic, tartar-emetic produces poisonous effects on the mucous coat of the alimentary canal. The best antidotes are infusions of yellow cinchona bark, galls, catechu, or any of the astringent vegetables, the tannin of which unites with the oxide of antimony, and forms an insoluble inert salt. But it is not easy to determine what is an over-dose of this salt in disease. The custom of prescribing it in large doses has lately been revived by Rasori and other Italians, and their example has been much followed by all the continental physicians. Laennec states that he gave it to the extent of forty-eight grains, in divided doses, in twenty-four hours, without any deleterious effect, and even without exciting vomiting, except on the first day. Dr. Christie, in a treatise on the nature and treatment of cholera, asserts that he has given ℈i at once, with the effect only of producing some vomiting and a few watery stools. The writer of this article, who has frequently prescribed it in doses of grs. iii, repeated every third hour, has observed that it seldom causes vomiting after the second or third dose. Rasori explains the power of sustaining such large doses, on the principle that a peculiar diathesis accompanies diseases of excitement, in which only such doses can be borne; and that it ceases as recovery takes place. Laennec, however, says that this power of endurance does not cease at the close of the fever, although it is diminished; a circumstance which, if the observation be correct, may be ascribed to the force of habit.

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* Scillitina was first obtained from the squill by Vogel. When pure, it is colourless, intensely bitter, with some sweetness, friable, and resembles a resin in its appearance and fracture, and is equally soluble in water, alcohol, and vinegar. It is deliquescent, gives viscosity to water; but differs from gum in not affording mucic acid when it is treated with nitric acid.

† It was discovered prior to the above date, but was first made known by Adrian Mynsicht, in his treatise entitled, Thesaurus Medico-Chemicus.

When tartar emetic proves poisonous, the symptoms resemble those of cholera; violent vomiting, diarrhœa, great pain and tension of the abdomen, and delirium; convulsions supervene, and death sometimes results. These symptoms have sometimes followed the administration of moderate doses. On examination of the body after death, the only marks of previous excitement are slight congestion in the brain, and a thickened state of the villous coat of the stomach and the duodenum, which is covered with a tough mucus.

Tartar emetic is administered in substance, in solution in water, and in solution in wine. The latter preparation is an objectionable one; the free tartaric acid of the wine converting the potassa into a bitartrate, and thus decomposing the triple salt; and the solution should always be made at the time it is to be taken. The solution in wine is chiefly employed in the diseases of children. Some practitioners still adhere to the opinion of Sydenham, who reprobates the use of antimonial emetics for children under eight years of age; but we have never seen any disadvantage follow their administration to children of two or three years of age; nor even, when judiciously employed, to infants at the breast.

A. T. Thomson.

EMMENAGOGUES, (from *ἐμμήνια*, the menses, and *ἄγω*, to induce,) are medicines which promote the menstrual discharge. It has been doubted whether any medicines operate directly upon the uterus; the decided influence of some in promoting its periodical discharge being referred to the diseased organ sharing in the salutary effect of such medicines on the general system. To determine fairly the correctness of this opinion, we must take into consideration the nature of the organ and its function in the unimpregnated state.

The texture of the uterus is fibrous, dense, compact, and abounding in blood-vessels; the veins are destitute of valves: it is also well supplied with nerves, and with lymphatics on its external surface. Internally it is lined with a soft, delicate, spongy membrane, composed chiefly of capillary vessels. Such is the organ:—what is its function in the unimpregnated state? How far is it adapted to perform the functions of a secreting organ? Is the periodical evacuation derived from it a true secretion, or a mere discharge from vessels oppressed by a local plethora?

In reply to the first query, it is scarcely necessary to say that its function is menstruation; a discharge periodically recurring once a month. The second and third queries involve a matter of controversy; but the prevailing opinion is in favour of the capacity of the uterus to secrete; and, consequently, that the discharge which it exudes is a real secretion. There is nothing in the anatomical structure of the uterus that unfits it for the function of secretion; and were any arguments necessary to refute the notion that menstruation depends on a general plethoric orgasm, it would be only necessary to bring forward the curious facts bearing on this point presented by the Hungarian twin sisters. These two females were united at the lower part of the back, and lived to the age of twenty-two. The same blood flowed in the vessels of each,—for the abdominal vessels were found, after death, united at the loins; yet the uterine function was distinct in both; it differed in its period, and also in the quantity of the discharge. Indeed, in reflecting on the nature of the organ itself, on its resemblance to other glandular organs in the manner in which it is supplied with blood, and on the adaptation of its internal surface to exhalation, we can have little hesitation in admitting that the manner in which the periodical discharge is supplied closely resembles that of a secreted fluid. The uterine arteries are not only exceedingly convoluted, but they are larger and have thinner coats than the veins, in the unimpregnated state: the blood is, therefore, brought into the organ readily and in considerable quantity, whilst it is slowly returned from it,—a state of vessels highly favourable to the secreting function. It is true that, previously to menstruation taking place, there are symptoms indicative of general plethora as well as of local congestion; yet this fact only proves that the discharge is connected with such a state of the system; not that it is caused by this state, nor that the relief which follows is attributable to *blood* being discharged by the uterine vessels. The admission, also, that there is an increased determination of blood to the organ at the period of menstruation, does not militate against the opinion that the discharge is a secretion; since it is well known that every glandular organ, when excited by its appropriate stimulus, becomes a centre, as it were, to which the blood is directed. Again, if this discharge were merely the effect of a local plethora, it would be blood, which is not the fact; for it does not coagulate like blood, nor does it contain fibrine. If it be thus evident from reasoning, that menstruation is not the mechanical result of a local congestion, let us examine how far observation supports the fact that it is a secretion.

The uterus, as we have already stated, resembles a gland in its vascular supply; and this resemblance extends to its diseases; an inflammatory state existing in it being often followed by scirrhus and cancer. Like other secreting organs, also, its function is often imperfectly performed, and the secretion, therefore, is liable to vitiation and derangement. In the first efforts of the organ the secretion is usually thin, colourless, defective in quantity, and its recurrence irregular and protracted: when it is suppressed, it cannot be restored by inducing plethora; nor can the flow, when it has commenced, be checked by venesection or any other means of depletion. In making this remark we must not be misunderstood: it is not our intention to assert that inordinate evacuations in other parts of the system do not influence the uterine discharge; on the contrary, we are perfectly aware that preternatural evacuations induced in the other organic systems will suspend the course of the catamenia, on the same principle that increased action of the intestinal system suspends the action of the cutaneous exhalents, and *vice versâ*, sweating checks diarrhœa. Any argument founded on the supposition that the structure of the uterus is not sufficiently glandular for a secreting organ must fall to the ground, when we reflect that the gastric juice is secreted by the stomach, an organ still less glandular than the uterus. We shall only add, that the correctness of the opinion that the catamenia are a secretion, does not depend altogether on circumstances connected with the organ itself; experience having ascertained that this discharge is intimately connected with the state of the ovaries; for when these organs are much diseased, or removed, or altogether absent, no menstruation occurs. It is not necessary to the establishment of the truth of our opinion that we should be able to explain the cause of the periodical return of the catamenia.

If menstruation depend, as we believe it does, on the secretory function of the uterus, it is obvious that in the unimpregnated state it ought always to happen at its regular period when the organ is in a natural or healthy state; and that in order to promote its return, when it is interrupted or suspended, such medicines must be employed as will tend to restore the organ to that precise state or condition on which the exercise of this function depends; and it is to these that the appellation *Emmenagogue* can only be properly applied. They may be such as will act either immediately on the uterus itself, or such as will merely influence that organ as a part of the general system; emmenagogues, therefore, may be arranged under two heads—*direct* and *indirect*. We shall be able to understand the manner in which both operate, and the propriety of employing the one or the other, only by having a clear idea of the nature of the morbid condition of the organ, and whether the obstruction or interruption of the periodical discharge depend on a diseased state of the uterus itself, or is the effect of the presence of other diseases in the system.

In some instances the suppression of menstruation is a primary affection, "often," as Dr. Denman has justly remarked, "although not universally, succeeded by a certain train of untoward symptoms;" but more frequently it is the result of other diseases; and, therefore, the nature of these, as well as the state of the patient with respect to vigour and constitution of body, must determine the kind of remedial agents to be selected as emmenagogues. Thus when the delay of the regular appearance of the discharge, after it has once appeared, occurs in females with a pale or leucophlegmatic countenance, indicating an atony of the vital powers, stimulant and tonic medicines are required, to give to the vascular system that degree of power which is necessary to maintain the healthy action of the capillaries: on the contrary, when the complexion is florid, when there is much tension of the system, or when the suppression is connected with great irritation of the uterine system, it is easy to understand that menstruation is more likely to be aided by whatever can diminish excitement and soothe and calm irritation than by stimulants. Thence the fact, that very different, nay very opposite remedies are required to remove amenorrhœa, in different instances.

Stimulants, whether corporeal or mental, undoubtedly tend to an early development of the uterine organs, and consequently to the appearance of menstruation sooner than is usual: thus in tropical climates, and in those females who indulge in luxurious and pampered habits, the age of puberty is earlier than in those who inhabit the temperate and frigid zones, and whose habits and passions are better regulated. The continued influence of stimulants is said, also, to prolong menstruation beyond the period of life at which it usually ceases; but this is at least problematical. All emmenagogues are more or less stimulants; and in cases in which a stimulant influence is contra-indicated, they cannot be employed until the excitement be reduced, and can then be only employed under certain restrictions.

When the uterine obstruction or irregularity is accompanied with a *pale* complexion and a languid state of the system, a variety of medicines are prescribed, either with a view of directly influencing the uterus by some specific action, or of invigorating the habit, and thence eventually promoting its secretory function. By the indiscreet use of the former, much injury may be done to the organ itself: on the latter, however judiciously prescribed, we cannot always depend; they may improve greatly the general health, and yet the catamenia may not reappear. It ought also to be well understood that idiosyncrasy, natural conformation, diseased states of the uterus itself, or of the ovaries, often are obstacles effectually opposed to the salutary influence of emmenagogues. As we have already mentioned, it has been doubted whether there is any medicinal agent which, when taken into the stomach, exerts a direct stimulant influence on the uterus: but if we admit that some substances find their way to particular organs,—for instance, nitre to the kidneys,—there is no reason why such should not be the case with regard to the uterus; experience, however, has not yet demonstrated that this is the case. But a stimulant effect may be propagated from neighbouring parts to the uterine vessels: thence some cathartics, which operate chiefly upon the rectum, influence the uterus.

When the obstruction is accompanied with a florid complexion, and "the colour of the cheeks is the flush, of disease, not the glow of health," (*Denman*,) before taking into consideration the uterine function, bleeding and other antiphlogistic means of treatment must be resorted to; and until the general excitement be subdued, the employment of emmenagogues would be injurious. It is also questionable, whether, even after this has been accomplished, any of the substances supposed to act directly on the uterus should be employed; but if they may be administered, they will be most likely to prove beneficial when given immediately after the reduction of the febrile excitement.

The employment of emmenagogues is not confined to cases of simple obstruction or suppression. In some females the pain with which menstruation is accomplished embitters much of life. Some of the substances employed as emmenagogues are supposed directly to lessen uterine irritation; and thence they are closely allied with sedatives and antispasmodics.

I. **Direct Emmenagogues.**—These may be divided into *immediate* and *mediate*.

1. The only immediate emmenagogue is *electricity*. It is well known that when this powerful agent is passed through any part of the body, a painful sensation is felt at the point of communication. Thus, if the knob of a discharging rod, connected with a chain communicating with the outside of a charged Leyden jar, be applied to one side of the pelvis, and the knob of the jar itself be applied to the side, a feeling will be instantly produced, as if a small sword was thrust through the part, and a stimulant impulse is given to the uterus, by the direct passage of the electrical fluid through it. The stimulant influence of a shock thus communicated, is obvious by the sensation which it excites; but it equally takes place, though in less degree, when no sensation is produced, as when a continued current of the fluid is passed through the organ, by making it a part of a circuit communicating with the prime conductor of an electrical machine. The direct application of electricity is admissible only when a torpor of the uterus exists, indicated by a suppression of the catamenia with a pale complexion and a languid state of the circulation. But even in this state of the habit and the organ, it must be remembered that, whilst applied in moderation, this agent rouses the activity of torpid parts, in large quantity it injures materially, if it do not destroy altogether the excitability of this organ. In employing electricity, therefore, as an emmenagogue, it should be first used under the form of accumulated electricity, or the bath as it is termed, then the aura, and, lastly, shocks should be given. At first, the shock should be moderate; as, in nervous habits, syncope has followed the unguarded communication of powerful shocks; but with ordinary caution in its application, electricity has been found a powerful agent in amenorrhœa, depending either on general debility of the system or atony of the uterus itself. (See ELECTRICITY.)

The influence of ergot of rye, secale *cornutum*, on the impregnated uterus, at the period of parturition, has led to the belief that it may be employed as a direct emmenagogue. Admitting that ergot acts directly upon the uterus, it cannot be denied that its influence in parturition is opposed to that which is requisite for exciting the uterine discharge. If menstruation be a secretory action, a certain supply of blood is requisite for its performance; but ergot acting on the motor nerves, and causing muscular contraction, would necessarily lessen this supply, and produce a state of parts more calculated to impede than to forward the menstrual discharge. Experience has also demonstrated that ergot has indeed very slender pretensions to the character of an emmenagogue.

2. The mediate direct emmenagogues comprehend both organic and inorganic substances. Among the former, madder, the root of the rubia *tinctorum*, has been long employed and relied upon, without any accurate idea of the manner in which it operates; although, from its tinging the urine and the bones of a red colour, it has been supposed that, as it passes into the circulation, it finds its way to the uterus, and directly influences that organ. The late Dr. Barton, an American physician of eminence, placed great reliance on its deobstruent powers; and it was also much esteemed by the late Dr. Home, of Edinburgh, who, in his clinical experiments and histories, has recorded his decided opinion of its efficacy as an emmenagogue. He gave it in doses of from ʒss to ʒi, twice or three times a day. But notwithstanding these authorities, madder is an equivocal emmenagogue, and is now rarely or never employed.

Savine, the leaves and herbaceous part of the juniperus *sabina*, which owes its stimulant properties to a volatile oil having some affinity to that of turpentine, is an energetic emmenagogue; and from its proneness to produce uterine hemorrhage, and cause abortion, there is some reason for the opinion that the volatile oil is taken into the circulation and acts directly upon the uterus, on which it exerts a stimulant influence. More than a century ago, its tendency to produce abortion led to its employment as an emmenagogue; but from an opinion expressed by Dr. Cullen, it fell into disrepute. In whatever manner it acts, savine, or its oil, is well adapted for cases of amenorrhœa connected with a feeble state of the constitution, and a languid circulation. The dose of the powder is from gr. v. to gr. x.; that of the oil, which can be readily formed into an oleo-saccharum, from *m*.ii. to *m*.vi. The extract, ordered by the Dublin Pharmacopœia, is a useless preparation; the volatile oil being dissipated by the heat necessary to be used in forming the extract.

Seneka root, the root of the polygala *senega*, is esteemed a useful and active emmenagogue by the American physicians. The active principle, which is supposed to be a peculiar salt, first noticed by Peschier, and named by him polygaline or polygalina,* resides in the bark of the root. Dr. Hartshorne, of Philadelphia, who first employed it as an emmenagogue, found that it was most useful in recent cases of amenorrhœa. He began its use two weeks previous to the expected appearance of the catamenia, giving it in the form of a saturated decoction, to the extent of a pint in twenty-four hours, pushing the dose as far as the stomach would permit, until the discharge appeared. Dr. Chapman, of Pennsylvania, adds his testimony to that of Dr. Hartshorne in favour of senega root, and believes that it exerts a specific action on the uterus; but it ought to be mentioned that the patient is directed to be prepared by an alterative course of calomel, carried to gentle ptyalism; on which account it is difficult to say how much is due to the mercurial, how much to the senega. If, however, the observations of the American physicians be correct, polygala *senega* merits the attention of British practitioners as an emmenagogue.

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* Peschier procured gr. 100 of this salt from 6 ounces of the root. He asserts that it is united with a peculiar acid, which he has called *polygalinic*.

No medicines perhaps merit more the appellation of direct mediate emmenagogues than the preparations of *mercury*. They effect almost a specific change upon the whole glandular system; and, consequently, if the glandular nature of the uterine function be admitted, it is easy to conceive that they are likely to affect the capillaries in the uterus, when these are in an unnatural or morbid condition. The preparation best suited for emmenagogue purposes is calomel; it is mild in its operation, and at the same time certain in its influence on the general system. In the combination in which it exists in Plummer's pill in particular, it has been found highly beneficial, the precipitated sulphuret of antimony greatly aiding its power. In this combination, it may be given in doses of from five to twelve grains every night and morning, until the gums be sensibly affected.

From what has been said, it is obvious that electricity is the only direct emmenagogue, and that the idea of the others acting upon the uterus itself is rather inferred than certain. It is nevertheless true, that, in whatever manner they act, they stimulate the uterus; and, therefore, some caution is requisite to be observed in their administration. Thus we must be certain that the suppression is not connected with pregnancy; and even when this is not the case, there is some difficulty in deciding upon the propriety of administering direct and stimulant emmenagogues; the uterus may be in such a state of active disease, as to render their influence upon it extremely hazardous.

II. **Indirect Emmenagogues.** The operation of these is effected in three ways:

1. By the substance operating on the kidneys or the intestinal canal, and stimulating the uterus by proximity.
2. By the substance acting on the stomach and improving the general health, so that the uterus shares the general salutary influence.
3. The uterus may be specifically acted upon through the medium of the nervous system.

The substances that operate in the first manner are, some diuretics, and those cathartics which especially stimulate the rectum. The diuretics are such as pass to the kidneys undecomposed, and powerfully stimulate these organs: thus nitre administered in doses of from ℈i to ʒi, in any bland fluid, possesses decided emmenagogue powers. Foxglove operates in the same manner. Among the emmenagogue cathartics, aloes holds the first rank. Its influence can only be referred to its action on the rectum, and its extension to the uterus, producing a state of the organ closely allied to that which is the result of the application of a direct stimulus to it. The powerful sympathetic influence of aloetics is well illustrated by the effect which sometimes follows their administration after the total cessation of the catamenia. For a certain period after this event takes place, the uterus retains the disposition to take on that state of vascular action which determines the periodical discharge; but it is incapable by its natural efforts to effect the discharge. In this state of uterine susceptibility, the excitement of the rectum by an aloetic purgative almost invariably induces the return of the menses in a slight degree, provided the cathartic be given at the period when the discharge had previously been accustomed to appear. Now if a purgative produce so powerful a sympathetic action when this uterine function has ceased to be any longer essential, we can readily imagine that a more powerful effect is likely to be the result of a similar extension of action from the rectum to the uterus at a period of life when the susceptibility to uterine impressions exists in a high degree. Experience has sufficiently demonstrated that such an extension of action really occurs. In prescribing aloes, however, as an emmenagogue, the cause of the suppression must be kept in view; for this medicine cannot be safely administered in an irritable state of the uterus. To secure its influence on the uterus, it is supposed necessary to administer the medicine in a solid form; but we are of opinion that this supposition is founded on a mistaken idea of its mode of acting; we have seen it most successful when it has been prescribed in conjunction with alkalies, which greatly aid its solubility. The administration of a pill containing one grain of calomel, the same quantity of powder of digitalis, and three of extract of conium, at bed-time, followed in the morning, by half an ounce of wine of aloes and myrrh, in conjunction with the mineral alkalies and ammonia, (See London Dispensatory, sixth edit. p. 941,) for two or three days previous to the expected return of the menstrual discharge, have, in our hands, proved generally successful. We are usually advised to avoid recommending the use of aloetics to persons subject to hemorrhoids; but although they operate chiefly on the large intestines, the idea that they produce hemorrhoids, or even rouse them to activity in those affected by them, unless the dose be very large, is doubtful.

Black hellebore, radix hellebori *nigri*, is another useful emmenagogue purgative of this class, adapted to plethoric habits: it probably acts by reducing that state of the system which is as adverse to the secretory action of every glandular organ as to that of the uterus. Mead pronounced a high eulogy on the emmenagogue properties of black hellebore; and it continued to be much employed until doubts of its efficacy were raised by Cullen and Heberden,[*] after which it fell into disrepute; but it is still much prescribed on the continent of Europe and in the United States of America. Dr. Chapman thus expresses himself regarding it: "It is especially useful when it purges, in painful menstruation, attended with torpor and constipation of the bowels, and perhaps with some degree of insensibility in the uterus itself." (Materia Medica.) From the violence of its action as a purgative, black hellebore requires to be administered with caution. If it be employed, the tincture is the best form of preparation; it may be added to any purgative, and thus aid in stimulating the uterus with less risk than is likely to attend the use of the root in substance or its infusion. The extract of the Edinburgh Pharmacopœia, in doses of from gr. iv. to gr. x., combined with extract of conium, has been found useful in the amenorrhœa of chlorotic girls. The same remarks apply to camboge. Serpentaria, valerian, and wormwood, have been employed, in various combinations, to produce emmenagogue effects, and seem to operate chiefly as stimulant antispasmodics. As such, the preparation of valerian, particularly the ammoniated tincture, is indicated in hysterical habits, when the circulation is in a languid state, and the menstrual discharge ushered in with an hysterical paroxysm: it seems to act chiefly by soothing the nervous turbulence; and may be given in doses of from f.℥i to f.℥ii, in combination with decoction of aloes.

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[*] Radix hellebori nigri facultatem movendi menstrua sibi vindicavit, quam tamen nullo satis firmo argumento usus mihi confirmavit.—*Commentarii de Morb. Hist. et Cur.* p. 261.

The inorganic substances in this division of emmenagogues are, principally, salts of iron, both natural and artificial. The former, which, as they exist in chalybeate waters, are carbonates or sulphates, are most beneficial when drunk at the springs; they raise the pulse in strength, and distribute the blood more equally; and, although the quantity of iron contained in the dose of the water, generally half a pint, be extremely small, yet it operates as a decided stimulant tonic. In plethoric individuals, it is often requisite to bleed and purge before the use of the chalybeate is commenced; and if nausea, pain of the præcordia, vomiting, vertigo, or a feeling of general fulness be, nevertheless, experienced after the waters have been taken, they should immediately be discontinued. All the varieties of chalybeate water prove beneficial in amenorrhœa connected with a pale leucophlegmatic habit; their operation is on the secretory system, which they influence in a slow but uniformly progressive manner, imparting tone, nervous energy, and general vigour. When the habit of the patient is sluggish, the pilula aloes cum myrrha may be administered with each dose of the water. The whole quantity of the chalybeate necessary to be taken in one day should be drunk in divided doses, betwixt each of which brisk walking exercise should be used. The artificial preparations require to be given in much larger doses than those contained in the chalybeate waters, a circumstance which has not been satisfactorily explained. The most common of the artificial preparations employed in amenorrhœa is the officinal *black oxide* of iron, the scales from the anvil purified. It is a compound of the protoxide and peroxide; the former of which combines readily with the acid of the stomach. The dose is from gr. v. to ℈i; it may be combined with an aromatic, and administered two or three times a day. Neither the liquor ferri alkalini, nor the ferrum ammoniatum, are active preparations: perhaps the most energetic of all the artificial chalybeates is the tincture of muriated iron; and it possesses the advantage of being compatible with many bitter tonic infusions and decoctions; as, for example, those of gentian, quassia, orange-peel, and such like. If the sulphate of iron be preferred, it should always be in the form of the proto-sulphate; but as this salt is rapidly converted into the persulphate when it is kept in the usual manner, it should be preserved in alcohol.[*] In the formation, also, of the mistura ferri composita, it would be preferable to add the sulphate of iron in solution to the mixture of myrrh and subcarbonate of potassa at the moment of taking the medicine, than to prepare it as ordered in the London and Dublin Pharmacopœiæ. When previously mixed, the carbonate of iron, which is at first formed by the exchange of acids between the salt of iron and the alkaline carbonate, is again rapidly decomposed, and transmuted into an inert peroxide of iron; whereas, when managed as we propose, the protocarbonate is formed in the stomach, and immediately exerts its influence upon it, operating as a powerful and effectual tonic emmenagogue. The dose of the protosulphate proper to mix with f.℥iss and of the myrrh and alkaline solution is four grains. Its influence is perceived by the rapid change which it induces on the alvine and renal evacuations; the black colour of the former, and the blue streak when the latter is tested with ferro-cyanate of potassa, demonstrating that the chalybeate has entered the circulation.

The mediate indirect emmenagogues, which influence the uterine function by their action on the nervous system, are all organic substances, both animal and vegetable. Their influence is chiefly useful when amenorrhœa accompanies highly irritable habits, and the suppression is connected with spasm and hysteria. We are of opinion that much confidence cannot be given to *castor* or to *musk*; galbanum and assafœtida are more useful; but they are to be regarded merely as aids to more powerful indirect emmenagogues.

On reviewing what has been said on this subject, it is evident that, with the exception of electricity, there is no method of directly stimulating the uterus on which much confidence can be placed; for little benefit has hitherto been derived from stimulating injections; and under these circumstances it may be reasonably questioned whether any medicinal agent can be correctly entitled to the appellation *emmenagogue*.

A. T. Thomson.

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[*] Green vitriol consists of 36 parts of protoxide of iron, + 40 of sulphuric acid, + 63 of water of crystallization, = 139; when exposed to the air, oxygen is absorbed, and an insoluble subsulphate produced, which consists of 40 parts of acid, + 160 peroxide of iron, = 200.

END OF THE FIRST VOLUME.

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